

66/2 : 5.31
U. S. DEPARTMENT OF COMMERCE

WEATHER BUREAU

KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.31

CATALOGUE OF METEOROLOGICAL
SATELLITE DATA—TIROS I
TELEVISION CLOUD
PHOTOGRAPHY



UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

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CLOUD PHOTOGRAPHY

ERRATA

	<u>FILM LEGEND</u>	<u>CHANGE</u>
Page 6	0004 D12	FRAME should be 32 32
6	0029 D2	REEL should be 102
6	0029 T1	Delete entire entry
8	0087 D2 0087 T2 0087 D12	Film legends and title frames are mislabeled 086
9	0118 D12	Read out pass is 0118; starting date and time is 0409 1509; FRAME should be 10 10
15	0574 T1	LEGEND should be 0574 D1*
18	0734* D12*	Delete entire entry
18	0734* T1	FRAME should be 18 18
18	0734* T2	FRAME should be 32 32
19	0734 T1	FRAME should be 31 31
19	0734 T2	FRAME should be 31 31

Page 6 Add:


151 0004 D2 K -- D2 -- -- 10 10

Page 14 Add:

157 0437 T2 K 0436 T2 0501 1316 05 05 15 16

Issued October, 1961

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U. S. DEPARTMENT OF COMMERCE
LUTHER H. HODGES, Secretary
WEATHER BUREAU
F. W. REICHELDERFER, Chief

KEY TO METEOROLOGICAL RECORDS DOCUMENTATION NO. 5.31

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TELEVISION CLOUD
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WASHINGTON, D.C.: 1961

PURPOSE

The Key to Meteorological Records Documentation Series has been established to provide guidance information to research personnel making use of climatological data.

Frequently users of such data have found it necessary to spend a great deal of time establishing whether the criteria for observing or computing various elements have changed over the period of record or in what form the data are available.

It is therefore hoped that the presentation of this series may not only conserve valuable time but may have a direct influence in improving the accuracy of research results.

PREFACE

This bulletin contains a complete listing of cloud photographs obtained by the TIROS I meteorological satellite, and a set of maps showing their geographical coverage. It also describes how copies of these photographs may be obtained from the National Weather Records Center.

Robert L. Pyle and Donald M. Mercer
Meteorological Satellite Laboratory

CATALOGUE OF METEOROLOGICAL SATELLITE DATA--
TIROS I TELEVISION CLOUD PHOTOGRAPHY

TIROS I, the first artificial satellite designed specifically to gather meteorological data, was launched by the National Aeronautics and Space Administration on April 1, 1960. Before the equipment ceased functioning in mid-June its two television cameras had taken and transmitted to earth about 20,000 pictures of the underlying cloud cover. It traveled in a nearly circular orbit averaging 390 nautical miles above the earth's surface with a difference of about 30 nautical miles between perigee and apogee. The orbit was inclined at an angle of 48.4 degrees to the earth's equatorial plane so that picture coverage is confined to the zone bounded roughly by 55 degrees north and south latitude. The satellite, with an orbital period of 99.24 minutes, circled the earth a fraction more than 14 times each day.

The satellite was spinning at a rate that varied between 8 and 12 r.p.m. Being spin-stabilized, the spin axis orientation in space changed only gradually during its operational lifetime and never deviated more than 20 degrees from the orbital plane. The two cameras were mounted with their optical axes parallel to the spin axis, so that the earth was within their fields of view during somewhat less than half of each orbital pass. Useable picture coverage was thus restricted to the portion of each orbital pass during which the underlying earth was both sunlit and within view of the cameras.

Camera 2, the wide-angle camera, had a 104-degree field of view and covered an area about 800 miles square when its optical axis was normal to the earth's surface; at other times a larger area was included in oblique perspective. Camera 1, with a 13-degree field of view, provided a magnified view of a much smaller area. The cameras were mounted on the satellite in such a way that an earth image in a camera-1 picture appears to be rotated 120 degrees counterclockwise with respect to its orientation in a simultaneous camera-2 picture.

Camera action aboard TIROS I was controlled from two Command-and-Data-Acquisition (CDA) stations, one located at Fort Monmouth, N. J., and the other at Kaena Point, Hawaii. The satellite came within radio range of one or both of these stations for a few minutes each on 8 or sometimes 9 of its 14 daily passes. During these radio contacts the station could:

- 1) receive a series of television pictures directly as they were taken, if it was daytime and the optical axes were appropriately oriented;
- 2) command the system to take pictures remote from the CDA station after a specified time delay and store them on tape aboard the satellite;
- 3) play back one previously commanded tape sequence from each camera.

Pictures received by the direct mode were taken only over the United States and nearby ocean areas, while tape sequences normally show other parts of the world. In the region traversed during the five or six daily passes when the satellite could not be contacted, picture coverage was limited to one tape sequence by each camera each day.

Direct pictures obtained on any one pass are grouped into one or two sequences depending on whether or not the series was interrupted to permit playback of a tape sequence. The time interval between frames was 30 seconds for most direct sequences, but

was 10 seconds for some of them. Direct sequences sometimes contain alternating frames from the two cameras.

Tape pictures were always taken at 30-second time intervals in sequences of up to 32 frames each. These sequences consist solely of pictures from one camera or the other. A pair of tape sequences taken by the two cameras on the same orbital pass are normally concurrent.

The pictures are virtually square with some small distortion resulting from the particular setting of the electronic readout equipment. "Fiducial marks" etched on the face of the vidicon tube appear in the picture image as a central cross and four L-shaped corners, although they may show poorly or not at all against a dark background.

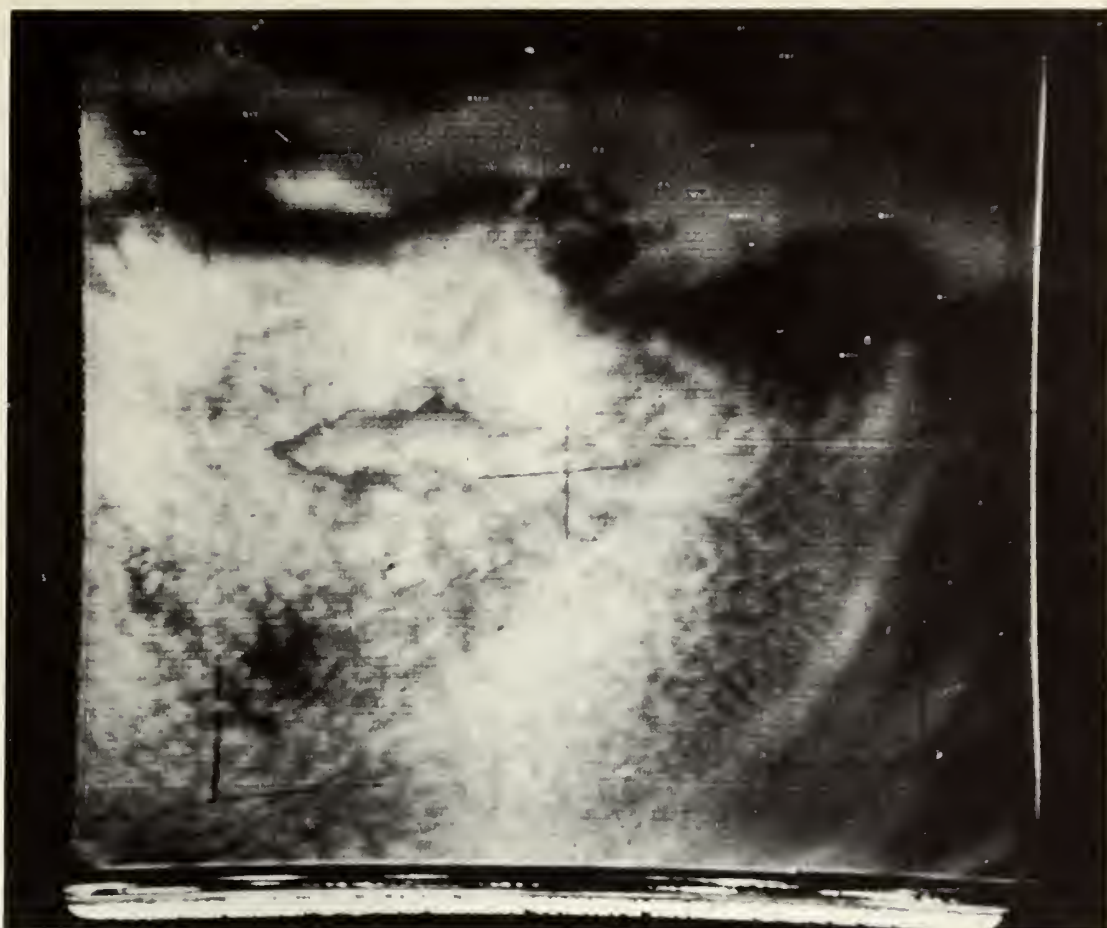
Since the satellite is spinning, the earth's image rotates from frame to frame by an amount that depends on how much the satellite's spin rate departed from being an integral number of rotations during the picture-taking interval. The rotation rate may be considered constant during any one sequence. The center of rotation, which is the point where the optical and spin axes intersect the image plane, is not quite at the central fiducial cross mark. It is displaced to the lower left on tape pictures and to the upper right on direct pictures by an amount about equal to the length of a half cross-arm (reference 1).

Cloud picture transmissions received at CDA stations were displayed on a television screen and simultaneously recorded on magnetic tape. A 35-mm. camera photographed the television screen, including also a lighted panel board mounted underneath. The panel board information provides a legend for each picture including the station, orbital pass number, camera number, and mode (tape or direct). In the example of figure 1, the legend indicates the picture was received on orbital pass no. 645, and that it is a tape picture taken by camera 2. The letter M at the lower right indicates the picture was acquired at the Fort Monmouth station. The panel board legend of Fort Monmouth pictures contains the letter M either in the upper left corner or along the lower right edge. The legend of Kaena Point pictures contains the letter H either in the upper left corner or lower down along the left edge. The letter C sometimes appears at the lower right, but has no significance in picture documentation. On a very few sequences from each station, the orbital pass number, station name, and a clock appear at the upper right.

The panel board legend also contains a series of numerals whose sum indicates frame number. In figure 1, the frame number is 7, representing the sum of 4, 2, and 1. (A similar series was intended to give information on sun angle, but the system did not work properly and the values cannot be easily interpreted.) Within each sequence, the indicated frame numbers increase in the order in which the pictures were received at the CDA station. For direct mode this is the time order in which the pictures were taken. But tape sequences were played back to the station in reverse time order. Pictures of both modes are arranged on the film in order of increasing frame number; therefore it is important to note that this is correct time order for direct sequences but is reverse time order for tapes. Malfunctioning frequently caused the frame counting system to behave erratically resulting in repetition and discontinuity in the frame number series.

The orderly time sequence of pictures is sometimes interrupted by spurious noise frames or complicated by skipped frames. In such cases the erratic frame numbers are not a dependable indicator of real picture counts. However, the regular rotation of image orientation is often a helpful clue in determining the actual time interval between particular frames.

The following pages of maps and tabulated listings give descriptive information about the pictures obtained by TIROS I. In the listings each picture sequence is described by one line, and for each station the sequences are listed in the order in which they appear on the film reel. The column headings and entries have the following



0 6 4 5

CAMERA

2

ORBIT NO.

TAPE

FRAME

1

2

4

SUN ANGLE

M.

8

32

64

Figure 1 - Example of TIROS I Cloud Photography

meanings:

REE: Number of the film reel which contains the sequence.

FILM LEGEND: This section gives the information actually appearing on the film in the panel board legend accompanying each picture. This information is used to identify the sequence on the film reel.

PASS: Orbital pass number on which the pictures were read out, as indicated in the legend.

M: Mode of transmission indicated in the legend.

D = Direct

T = Tape

C: Camera number indicated in the legend.

1 = Narrow angle camera

2 = Wide angle camera

12 = Both cameras alternating

S: CDA station which received the sequence.

K = Kaena Point, Hawaii

M = Fort Monmouth, N. J.

(When the panel board legend contains an error, the information as it appears on the film is listed under FILM LEGEND with an asterisk to indicate an erroneous designation. An asterisk following the camera number indicates an error in either mode or camera or both. In such instances, the correct symbols for mode and camera can be found in the PICTURE SEQUENCE DATA section. Errors in readout orbital pass number involve only a difference of one in the last digit. For direct sequences the correct number is the same as the picture-taking pass number listed under PICTURE SEQUENCE DATA. For tape sequences the correct number usually can be deduced by comparison with preceding and following sequences. On the film reels, legend inaccuracies are indicated in the sequence title frame by the word ERROR followed by O, C, or M for orbital pass, camera, or mode as appropriate. Unfortunately, errors in frame number and sun angle are too numerous to designate individually in this manner.)

PICTURE SEQUENCE DATA: This section documents the picture content. Sequences having no useable frames are included on the film reel but are not documented in this section.

STARTING TIME:

PASS: Orbital pass number on which the first picture of the sequence was taken. For direct sequences this pass number and the readout pass number given under FILM LEGEND are the same. However, for tape sequences, picture taking usually began on an earlier pass.

M: Actual mode of transmission, coded as in FILM LEGEND.

C: Actual camera used, coded as in FILM LEGEND.

DATE: Month and day when the first picture was taken.

TIME: Hour and minute (GMT) when the first picture was taken. On the film reel, the first picture is found at the beginning of direct sequences but at the end of tape sequences because the latter are arranged on the film in reverse time order.

FRAME:

US: Number of useable frames in the sequence.

+: Number of frames in which the central fiducial cross mark appears on the earth, indicating that the earth's image occupies a substantial portion of the picture.

GEOGRAPHICAL AREA COVERED: Column headings refer to numbered areas outlined on the first map. Column entries indicate the areas included in the picture sequence.

L: Presence of a landmark is indicated by the following code:

1 = Possible ground image somewhere in the sequence.

2 = Ground image present but not identified.

3 = Identified ground image.

VBS: The presence of a vortex, cloud bands, or cloud streets in the sequence is indicated by a 2 in the appropriate column. Since all sequences were not routinely examined using uniform criteria for the presence of these features, the absence of a 2 does not necessarily mean that none is present.

Following the listings is a series of maps which provide a rough indication of the area covered by each sequence having useable frames. The coverage swaths are grouped by date and are identified by the picture-taking pass number and mode. CDA station initial is added when necessary to identify definitely the sequence to which the swath applies.

NOTE THAT SEQUENCE SWATHS ON THE MAPS ARE LABELED WITH THE PICTURE-TAKING PASS NUMBER LISTED UNDER "PICTURE SEQUENCE DATA", BUT ON THE FILM THE CORRESPONDING PICTURES ARE IDENTIFIED BY THE READOUT PASS NUMBER LISTED UNDER "FILM LEGEND."

Two direct sequences acquired at the same station on the same orbital pass are normally combined in one swath, since the short interruption for tape playback usually does not cause a significant gap in the coverage. When camera-1 and camera-2 tape sequences are concurrent they are represented on the maps by one swath showing camera-2 coverage.

Since the orientation of each frame with respect to compass directions on the earth has not been calculated, the swaths have been computed to show the coverage that would have been obtained if the square pictures were all oriented with sides parallel to the orbital track.

A report (reference 1) of the Meteorological Satellite Laboratory describes the problems and uncertainties in specifying the satellite's attitude as a function of time, and presents graphs and tables needed to locate accurately TIROS I pictures.

TIROS I master films are on deposit at the National Weather Records Center (NWRC), U. S. Weather Bureau, Arcade Building, Asheville, North Carolina. Persons or institutions desiring copies may order them from the NWRC in the form of 35-mm. positive transparencies for projection or 35-mm. duplication negatives from which opaque prints can be made. The pictures are stored chronologically on 100-foot reels. A full set of either positive or negative TIROS I pictures occupies 50 reels. Orders must be placed for one or more complete reels, at a cost of \$4.00 each, as it is not now possible to furnish copies of individual frames or to provide enlargements or other picture formats. Reel number should be given when ordering. These film copies will be furnished without sprocket holes unless a specific request to the contrary is made when placing the order. Copies with sprocket holes are not suitable for movie projection, and are priced at \$5.00 per reel.

REFERENCE

1. L. F. Hubert: "TIROS I: Camera attitude data, analysis of location errors, and derivation of correction for calibration," Meteorological Satellite Laboratory Report No. 5, U.S. Weather Bureau, Washington, D.C., 1961.

REEL	FILM LEGEND				PICTURE SEQUENCE DATA																								
					STARTING TIME				FRAME	GEOGRAPHICAL AREA COVERED																	LVBS		
	PASS	M	C	S	PASS	M	C	DATE	TIME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16	17
101	0001	D	2	M				D	2		00																		
101	0001	D	2	M	0001	D	2	0401	1331	29	01			3	4														1
101	0002	D	2	M	0002	D	2	0401	1513	10	10			3	4														3
101	0002	D	2	M				D	2		00																		
101	0002	D	1	M				D	1		00																		
101	0003	D	2	M	0003	D	2	0401	1706	22	22					4	5												1
101	0004	D	12	M	0004	D	12	0401	1839	51	51			3	4														1
101	0005	D	2	M	0005	D	2	0401	2025	38	38			3	4														1
151	0007	D	2	K	0007	D	2	0401	2340	07	07			2															2
151	0007	T	2	K	0006	T	2	0401	2157	30	28			2	3														1
151	0007	T	1	K	0006	T	1	0401	2157	09	07			2	3														32
151	0007	D	2	K	0007	D	2	0401	2345	26	26			2	3														1
151	0008	D	2	K	0008	D	2	0402	0123	08	08			2															1
151	0008	T	2	K	0008	T	2	0402	0104	25	08			1	2			7											1
151	0008	T	1	K	0008	T	1	0402	0104	04	04			1	2			7											
151	0008	D	12	K	0008	D	12	0402	0127	15	15			2						9									1
151	0009	D	2	K	0009	D	2	0402	0310	04	04							8											1
151	0009	T	2	K	0009	T	2	0402	0250	31	26			1	2			7											2
151	0009	T	1	K	0009	T	1	0402	0250	21	21			1	2			7											
151	0009	D	12	K	0009	D	12	0402	0314	05	05							9						14					1
101	0014	D	2	M				D	2		00																		
101	0014	T	2	M				T	2		00																		
101	0014	T	1	M				T	1		00																		
101	0015	D	2	M				D	2		00																		
101	0015	T	2	M	0014	T	2	0402	1105	32	30					5	6	7											3
101	0015	T	1	M	0014	T	1	0402	1105	03	01					5	6	7											3
101	0015	D	1	M				D	1		00																		
101	0016	D	2	M	0016	D	2	0402	1418	05				3	4														122
101	0016	T	2	M	0015	T	2	0402	1249	31	31					5	6												3
101	0016	T	1	M	0015	T	1	0402	1249	15	13					5	6												2
101	0016	D	1	M	0016	D	1	0402	1424	10	03					4	5												122
101	0017	D	2	M	0017	D	2	0402	1603	06				3	4														1
101	0017	T	2	M	0016	T	2	0402	1446	32	32										11	12					17		3
101	0017	T	1	M				T	1		00																		
101	0017	D	12	M	0017	D	12	0402	1608	22	22					4	5												1
151	0017	D	12	K				D	12		00																		
151	0017	D	12	K				D	12		00																		
101	0018	D	2	M	0018	D	2	0402	1747	06	06			3	4														1
101	0018	T	2	M	0017	T	2	0402	1623	16	16									11						16	17		2
101	0018	T	1	M	0017	T	1	0402	1623	20	20									11						16	17		2
101	0018	D	12	M	0018	D	12	0402	1753	09	09					4	5												1
151	0018	D	12	K				D	12		00																		
151	0018	D	12	K				D	12		00																		
101	0019	D	12	M	0019	D	12	0402	1931	06	06			3	4														122
101	0019	T	1	M				T	1		00																		
101	0019	T	2	M	0019	T	2	0402	1912	16	03			1	2														1
101	0019	D	12	M	0019	D	12	0402	1937	11	11			3	4					10									122
151	0019	D	2	K	0019	D	2	0402	1917	05				2															1
151	0021	D	2	K				D	2		00																		
151	0021	T	2	K	0020	T	2	0402	2101	31	26			1	2	3													3
151	0021	T	1	K	0020	T	1	0402	2101	23	23			1	2	3													
151	0021	D	12	K	0021	D	12	0402	2252	05	05			2	3														1
151	0022	D	1	K	0022	D	1	0403	0029	25	25			2															2
151	0022	T	1	K				T	1		00																		
151	0022	D	12	K	0022	D	12	0403	0035	09	09			2						9									1
151	0023	D	1	K	0023	D	1	0403	0213	12	12			1	2														1
151	0023	T	1	K				T	1		00																		
151	0023	D	2	K				D	2		00																		
101	0028	D	1	M				D	1		00																		
101	0028	T	1	M				T	1		00																		
101	0028	T	2	M	0025	T	2	0403	0521	25	10			1				7											1
101	0028	D	2	M				D	2		00																		
101	0029	D	2	M				D	2		00																		
102	0029	D	2*	M	0028	D	2	0403	1014	32	25					5	6	7											3222
102	0029	T	1	M				T	1		00																		
102	0029	D	2	M				D	2		00																		
102	0030	D	2	M				D	2		00																		
102	0030	T	1	M				T	1		00																		
102	0030	T	2	M				T	2		00																		
102	0030	D	2	M	0030	D	2	0403	1331	28	03					3	4	5											1
102	0031	D	12	M	0031	D	12	0403	1517	10	10					3	4	5											1
151	0031	D	1	K				D	1		00																		
151	0031	T	1	K				T	1		00																		
151	0031	T	2	K	0030	T	2	0403	1346	32	32					5	6				11								3
102	0032	D	12	M	0032	D	12	0403	1653	24	23			3	4	5													1
102	0032	D	12	M				D	12		00																		
151	0032	D	2	K				D	2		00			</															

REEL	FILM LEGEND				PICTURE SEQUENCE DATA																	LVBS									
	PASS	M	C	S	PASS	M	C	DATE	TIME	FRAME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
151	0032	T	2	K	0031	T	2	0403	1524	32	32						5	6					11							3	
151	0032	T	1	K						00																					
102	0033	D	2	M						00																					
102	0033	D	2*	M	0032	T	2	0403	1710	31	31											10	11					16		1	
152	0036	D	12	K	0036	D	12	0403	2336	06	06		1	2																1	
152	0036	T	2	K	0034	T	2	0403	2014	32	32			2	3	4						10								3	
152	0036	D	12	K	0036	D	12	0403	2344	11	11			2							9									1	
152	0037	D	12	K	0037	D	12	0404	0120	08	08		1	2																1	
152	0037	T	2	K	0037	T	2	0404	0101	25	11		1	2					7											3	
152	0037	D	12	K	0037	D	12	0404	0127	12	12			2							9									1	
102	0042	D	2	M						00																					
102	0042	T	2	M	0040	T	2	0404	0611	32	32		1							7	8									1	
102	0043	D	2	M						00																					
102	0043	T	2	M	0042	T	2	0404	0928	32	32							6	7				12							3	
102	0043	D	12	M						00																					
102	0044	D	2	M						00																					
102	0044	T	2	M	0043	T	2	0404	1104	31	23							5	6											32	
102	0044	D	12	M	0044	D	12	0404	1235	03								4	5											1	
102	0045	D	12	M	0045	D	12	0404	1414	11								3	4	5										12	
152	0045	D	2	K						00																					
152	0045	T	2	K	0044	T	2	0404	1246	32	32							4	5	6			11							3	
102	0046	D	12	M	0046	D	12	0404	1559	24	18							3	4	5										1	
102	0046	D	12	M						00																					
102	0047	D	12	M	0047	D	12	0404	1743	25	23		2	3	4															1	
102	0047	D	12	M						00																					
152	0047	T	2	K	0045	T	2	0404	1427	29	29							4	5	6			11							3	
152	0047	T	1	K						00																					
152	0047	D	12	K						00																					
102	0048	D	12	M	0048	D	12	0404	1928	16	16							3	4											12	
152	0050	D	12	K	0050	D	12	0404	2243	06	06		1	2																1	
152	0050	T	2	K	0049	T	2	0404	2100	01	01		1	2	3																1
152	0050	D	12	K	0050	D	12	0404	2249	11	11				2	3														122	
152	0051	D	12	K	0051	D	12	0405	0026	10	10		1	2																1	
152	0051	T	2	K	0051	T	2	0405	0008	29	08		1	2					7											1	
152	0051	D	1	K	0051	D	1	0405	0033	11	11				2						9									1	
152	0052	D	12	K	0052	D	12	0405	0212	14	14			2						8	9									1	
102	0057	D	2	M						00																					
102	0057	T	2	M						00																					
102	0057	D	2	M						00																					
102	0058	T	2	M	0057	T	2	0405	1013	32	24							5	6				12							32	
102	0058	D	2	M	0058	D	2	0405	1146	05								4	5												
103	0059	D	2	M	0059	D	2	0405	1321	08								4	5											1	
103	0059	D	12	M						00																					
152	0059	T	1	K						00																					
152	0059	D	2	K						00																					
103	0060	D	12	M	0060	D	12	0405	1505	18	08							3	4	5										3	
103	0060	D	12	M						00																					
152	0060	D	12	K						00																					
152	0060	T	1	K						00																					
152	0060	T	2	K	0058	T	2	0405	1154	31	28							5	6				11							32	
152	0060	D	12	K						00																					
103	0061	D	12	M	0061	D	12	0405	1650	19	12							3	4											122	
103	0061	D	12	M						00																					
152	0061	D	12	K						00																					
152	0061	T	1	K						00																					
152	0061	T	2	K	0060	T	2	0405	1519	30	30							4	5				10	11						1	
152	0061	D	12	K						00																					
103	0062	D	12	M	0062	D	12	0405	1834	04	04							3												1	
103	0062	D	1*	M	0061	T	2	0405	1704	32	32							4	5				10	11				16		1	
103	0062	D	12	M	0062	D	12	0405	1839	10	10							3	4												
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152	0064	D	2	K	0064	D	2	0405	2153	05	05		2																	122	
152	0064	T	2	K						00																					
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152	0065	D	2	K	0065	D	2	0405	2335	09	09																			1	
152	0065	T	2	K	0065	T	2	0405	2316	18	01		1	2																12	
152	0065	D	2	K	0065	D	2	0405	2341	10	10										9									1	
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103	0071	D	2	M						00																					
103	0071	T	2	M	0068	T	2	0406	0426	30	04		1							7	8									1	
103	0072	D	1	M						00				</																	

REEL	FILM LEGEND			PICTURE SEQUENCE DATA																	LVBS												
	PASS	M	C	S	PASS	M	C	DATE	TIME	FRAME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17				
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103	0075	D	2	M						00																							
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103	0076	D	2	M	0076	D	2	0406	1747	10 10							4															3	
153	0078	D	1	K						00																							
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153	0079	D	2	K	0079	D	2	0406	2240	09 07						1	2															1 2	
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153	0079	D	2	K						00																							
103	0085	D	2	M						00																							
103	0085	T	2	M	0080	T	2	0407	0008	31 04						1	2				7											2	
103	0086	D	2	M						00																							
103	0086	T	2	M	0085	T	2	0407	0830	31 20							5	6	7					12								3 2	
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103	0088	D	12	M						00																							
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103	0090	D	12	M	0090	D	12	0407	1650	13 10							3	4														1	
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153	0094	T	2	K	0094	T	2	0407	2314	20 03							1	2														1	
153	0094	D	12	K	0094	D	12	0407	2335	08 08							1	2														1	
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104	0101	T	1	M						00																							
104	0101	T	2	M	0100	T	2	0408	0918	31 11								5	6	7			11									322	
104	0102	D	2	M						00																							
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104	0102	D	2	M	0102	D	2	0408	1230	11								4														1	
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153	0103	D	2	K						00																							
153	0103	T	2	K	0102	T	2	0408	1242	03 03									5	6			11									1	
104	0104	D	2	M	0104	D	2	0408	1554	13								2	3	4												1	
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153	0104	D	2	K						00																							
153	0104	T	2	K	0103	T	2	0408	1427	31 31									5				10	11								1	
104	0105	D	2	M						00																							
104	0105	T	2	M	0104	T	2	0408	1610	30 30									5				10	11								16	
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153	0107	T	2	K						15 02								2	3				9									1	
153	0107	D	12	K						00																							
153	0108	D	12	K	0108	D	12	0408	2238	05 05								1	2													1	
153	0108	T	2	K	0108	T	2	0408	2219	14																							1
153	0108	D	12	K	0108	D	12	0408	2245	07 07								2					9									1	
153	0109	T	2	K	0109	T	2	0409	0004	20								1				7										1	
153	0109	D	2	K	0109	D	2	0409	0022	06 06								1	2				8	9								1	
153	0109	D	12	K	0109	D	12	0409	0028	03 03								2					8	9									

REEL	FILM LEGEND				PICTURE SEQUENCE DATA																								
					STARTING TIME				FRAME		GEOGRAPHICAL AREA COVERED																	LVBS	
	PASS	M	C	S	PASS	M	C	DATE	TIME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		17
104	0116	D	2	M			D	2		00																			
153	0117	D	2	K			D	2		00																			
153	0117	T	2	K	0116	T	2	0409	1149	31	19					5	6					11						1	
104	0117	D	12	M			D	12		00																			
153	0118	D	2	K			D	2		00																			
153	0118	T	2	K	0117	T	2	0409	1334	32	31					4	5					10						3	
104	0118	D	2	M			D	2		00																			
104	0118	D	12	M			D	12		00																			
104	0119	D	2	M	0119	D	2	0409	1645	08	08					3												1	
104	0119	T	2	M	0118	T	2	0409	1517	32	32						4	5				10	11				16		
104	0119	D	12	M	0119	D	12	0409	1653	09	09					3	4					10						1	
153	0121	D	2	K	0121	D	2	0409	2002	06						2												1	
153	0122	D	2	K	0122	D	2	0409	2145	09						2												1	
153	0122	T	2	K	0120	T	2	0409	1824	31	12					2	3	4				9	10					3	
153	0122	D	12	K	0122	D	12	0409	2151	08	08					2						9						1	
153	0123	D	12	K	0123	D	12	0409	2329	04	04			1	2													1	
153	0123	T	2	K	0122	T	2	0409	2159	30	30										9				14	15			
153	0123	D	12	K	0123	D	12	0409	2335	05	04			2							8	9						1	
104	0128	T	2	M	0125	T	2	0410	0255	30	30			1							8				13				
105	0129	D	2	M			D	2		00																			
105	0129	T	2	M	0128	T	2	0410	0728	22								6										1	
105	0129	T	1	M			T	1		00																			
105	0130	D	2	M			D	2		00																			
154	0131	D	2	K			D	2		00																			
154	0131	T	2	K	0129	T	2	0410	0919	30	28						5	6					11	12				1 2	
105	0131	D	2	M			D	2		00																			
105	0131	D	2	M	0131	D	2	0410	1223	05							4											1	
105	0132	D	2	M	0132	D	2	0410	1408	17						3	4	5										1	
105	0132	D	2	M			D	2		00																			
154	0132	D	2	K			D	2		00																			
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105	0133	D	2	M	0133	D	2	0410	1552	02						3	4											1	
105	0133	T	2	M	0132	T	2	0410	1425	31	31							5				10	11						
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154	0136	D	2	K	0136	D	2	0410	2051	05			1	2														1 2	
154	0136	T	2	K	0134	T	2	0410	1734	28	13			2	3	4						10						1 2	
154	0136	D	12	K	0136	D	12	0410	2058	05	05																	1 2	
154	0137	D	2	K	0137	D	2	0410	2235	06	02			1	2													1 2	
154	0137	T	2	K	0136	T	2	0410	2106	32	32					2						9				14			
154	0137	D	12	K	0137	D	12	0410	2241	14	14			2								9						1 2	
105	0143	D	2	M			D	2		00																			
105	0143	T	2	M	0140	T	2	0411	0340	31	31			1								8				13			
105	0144	D	2	M			D	2		00																			
105	0144	T	2	M	0143	T	2	0411	0824	28	12							6	7				11					3	
105	0145	D	2	M			D	2		00																			
105	0145	T	2	M	0144	T	2	0411	1010	32	25							5	6				11					1	
105	0145	D	2	M			D	2		00																			
154	0146	D	2	K			D	2		00																			
154	0146	T	2	K	0145	T	2	0411	1149	32	25							5	6				11					1	
105	0146	D	2	M			D	2		00																			
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105	0147	D	2	M	0147	D	2	0411	1459	04						3												1 2	
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105	0147	D	12	M	0147	D	12	0411	1504	08							4											1 2	
105	0148	D	2	M			D	2		00																			
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154	0150	D	2	K	0150	D	2	0411	1959	04				2														1	
154	0150	T	2	K	0149	T	2	0411	1822	31	11			2	3							9						1 2	
154	0150	D	2	K	0150	D	2	0411	2003	04				2														1	
154	0151	D	2	K	0151	D	2	0411	2142	07			1	2														1 2	
154	0151	T	2	K	0150	T	2	0411	2013	32	32					3						9				14			
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154	0152	D	12	K	0152	D	12	0411	2328	15	14			1	2							8	9					1	
105	0157	D	2	M			D	2		00</																			

[illegible]

REEL	FILM LEGEND				PICTURE SEQUENCE DATA																	LVBS							
					STARTING TIME				FRAME	GEOGRAPHICAL AREA COVERED																			
										PASS M C S	PASS M C DATE TIME	US +	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17																
109	0276	D	2*	M	0275	T	2	0420	1053	31	25							10	11						16		1		
156	0279	D	2	K		D	2			00																			
156	0279	T	2	K	0277	T	2	0420	1410	31	18							10						15			3		
156	0279	D	2	K		D	2			00																			
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156	0280	T	2	K	0279	T	2	0420	1732	32	24						9						14	15			1		
156	0280	D	2	K	0280	D	2	0420	1901	11							9										1		
110	0286	D	2	M		D	2			00																			
110	0286	T	2	M	0283	T	2	0421	0001	29	08						8					13					1		
110	0287	D	2	M		D	2			00																			
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110	0288	T	2	M	0287	T	2	0421	0643	31	17											11	12		17		1		
110	0288	T	1	M		T	1			00																			
110	0289	D	2	M		D	2			00																			
110	0288*	T	2	M	0288	T	2	0421	0821	31	16											11			16	17	1		
110	0290	D	2	M		D	2			00																			
110	0290	T	2	M	0289	T	2	0421	1001	32	15											11			16	17	1		
110	0291	D	2	M		D	2			00																			
110	0291	T	2	M	0290	T	2	0421	1139	31	31											10	11		16		1		
156	0293	D	2	K		D	2			00																			
156	0293	T	2	K	0291	T	2	0421	1319	31	15											10			15	16	3		
156	0294	D	2	K		D	2			00																			
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156	0295	D	2	K		D	2			00																			
156	0295	T	2	K	0294	T	2	0421	1819	32	19														14				
156	0295	D	2	K	0295	D	2	0421	1952	09							8	9									1		
110	0300	D	2	M		D	2			00																			
110	0300	T	2	M	0297	T	2	0421	2315	31	15											8			13		3		
110	0301	D	2	M		D	2			00																			
110	0301	T	2	M	0300	T	2	0422	0412	29	13													12	13		17		
110	0301	T	1	M		T	1			00																			
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110	0304	T	1	M		T	1			00																			
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110	0305	T	2	M	0304	T	2	0422	1048	31	13												10	11		16			
156	0308	D	2	K		D	2			00																			
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156	0309	D	2	K		D	2			00																			
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111	0315	D	2	M		D	2			00																			
111	0315	T	2	M	0314	T	2	0423	0326	32	22													12	13		17		
111	0315	T	1	M		T	1			00																			
111	0316	D	2	M		D	2			00																			
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111	0316	T	1	M		T	1			00																			
111	0317	D	2	M		D	2			00																			
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111	0318	D	2	M		D	2			00																			
111	0317*	T	2	M	0317	T	2	0423	0826	31	27													11			16	17	1
111	0319	D	2	M		D	2			00																			
111	0319	T	2	M	0318	T	2	0423	0943	07													10						
156	0322	D	2	K		D	2			00																			
156	0322	T	2	K	0320	T	2	0423	1323	31	26												10			15	16	1	
156	0322	D	2	K		D	2			00																			
156	0323	D	2	K		D	2			00																			
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156	0323	T	1	K		T	1			00																			
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111	0329	T	2	M	0325	T	2	0423	2133	31	15												8			13	14	1	
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111	0330	T	2	M	0329	T	2	0424	0420	32	32														12	13		17	
111	0330	T	1	M		T	1			00																			
111	0331	D	2	M		D	2			00																			
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111	0331	T	1	M		T	1			00																			
111	0333	D	2	M		D	2			00																			
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111	0333	T	1	M		T	1			00																			
156	0336	D	2	K		D	2			00																			
156	0336	T	2	K	0335	T	2	0424	1412	31	24													10			15	16	1

REEL	FILM LEGEND				PICTURE SEQUENCE DATA																								
					STARTING TIME				FRAME	GEOGRAPHICAL AREA COVERED																	LVBS		
	PASS	M	C	S	PASS	M	C	DATE	TIME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		16	17
156	0337	D	2	K					D 2																				
156	0337	T	2	K	0336	T	2	0424	1552	32	26								9						14	15	16	3	
156	0337	D	2	K					D 2																				
112	0343	D	2	M					D 2																				
112	0343	T	2	M	0339	T	2	0424	2048	31	24							8						13	14				
112	0344	D	2	M					D 2																				
112	0344	T	2	M	0343	T	2	0425	0328	31	27												12	13			17		
112	0344	T1		M					T1																				
112	0345	D	2	M					D 2																				
112	0345	T	2	M	0344	T	2	0425	0505	32	25												12	13			17		
112	0346	D	2	M					D 2																				
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112	0346	T1		M					T1																				
112	0347	D	2	M					D 2																				
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REEL	FILM LEGEND				PICTURE SEQUENCE DATA																								LVBS	
					STARTING TIME				FRAME	GEOGRAPHICAL AREA COVERED																				
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REEL	FILM LEGEND			PICTURE SEQUENCE DATA																	LVBS											
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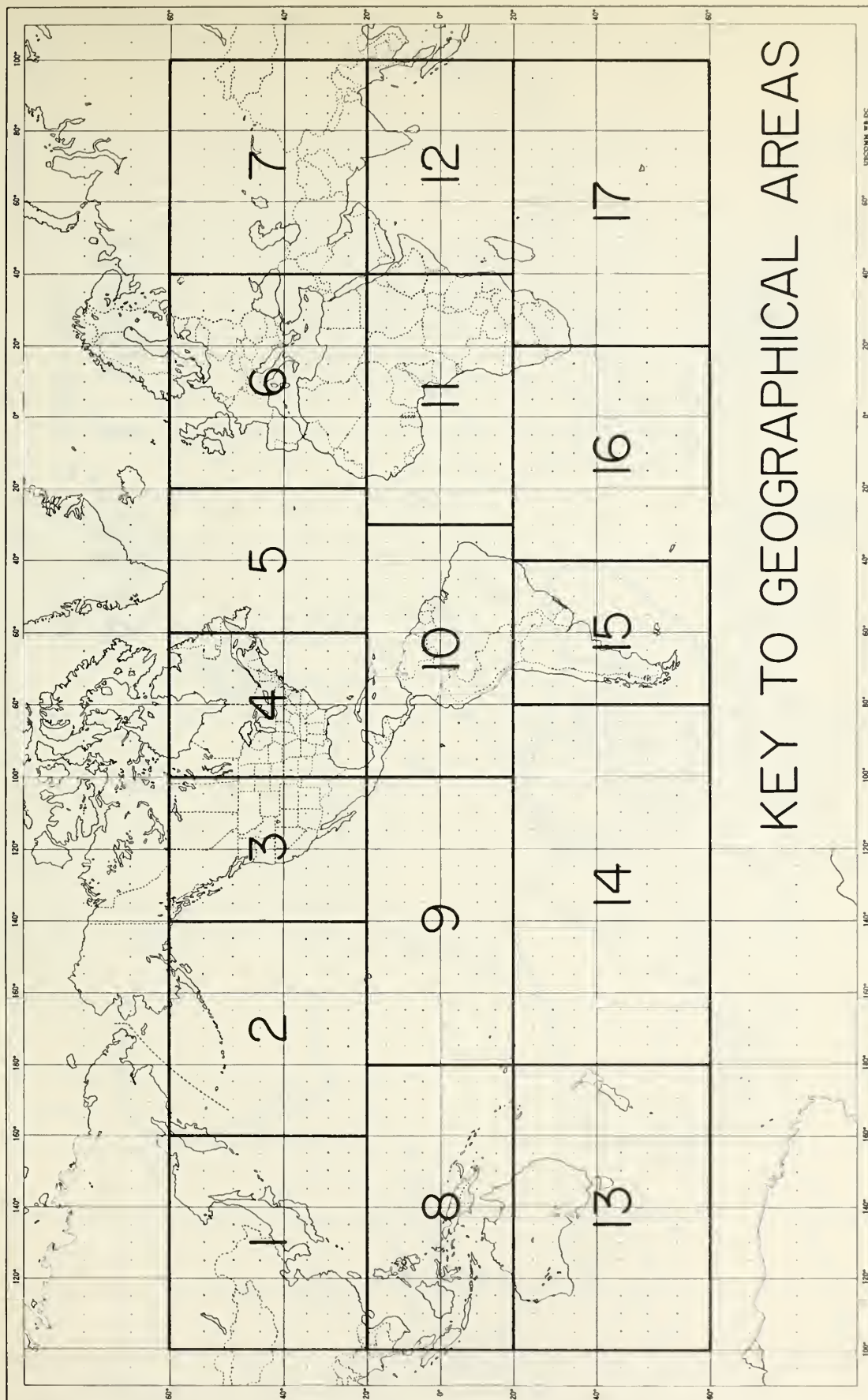
REEL	FILM LEGEND				PICTURE SEQUENCE DATA																	LVBS							
					STARTING TIME				FRAME	GEOGRAPHICAL AREA COVERED																			
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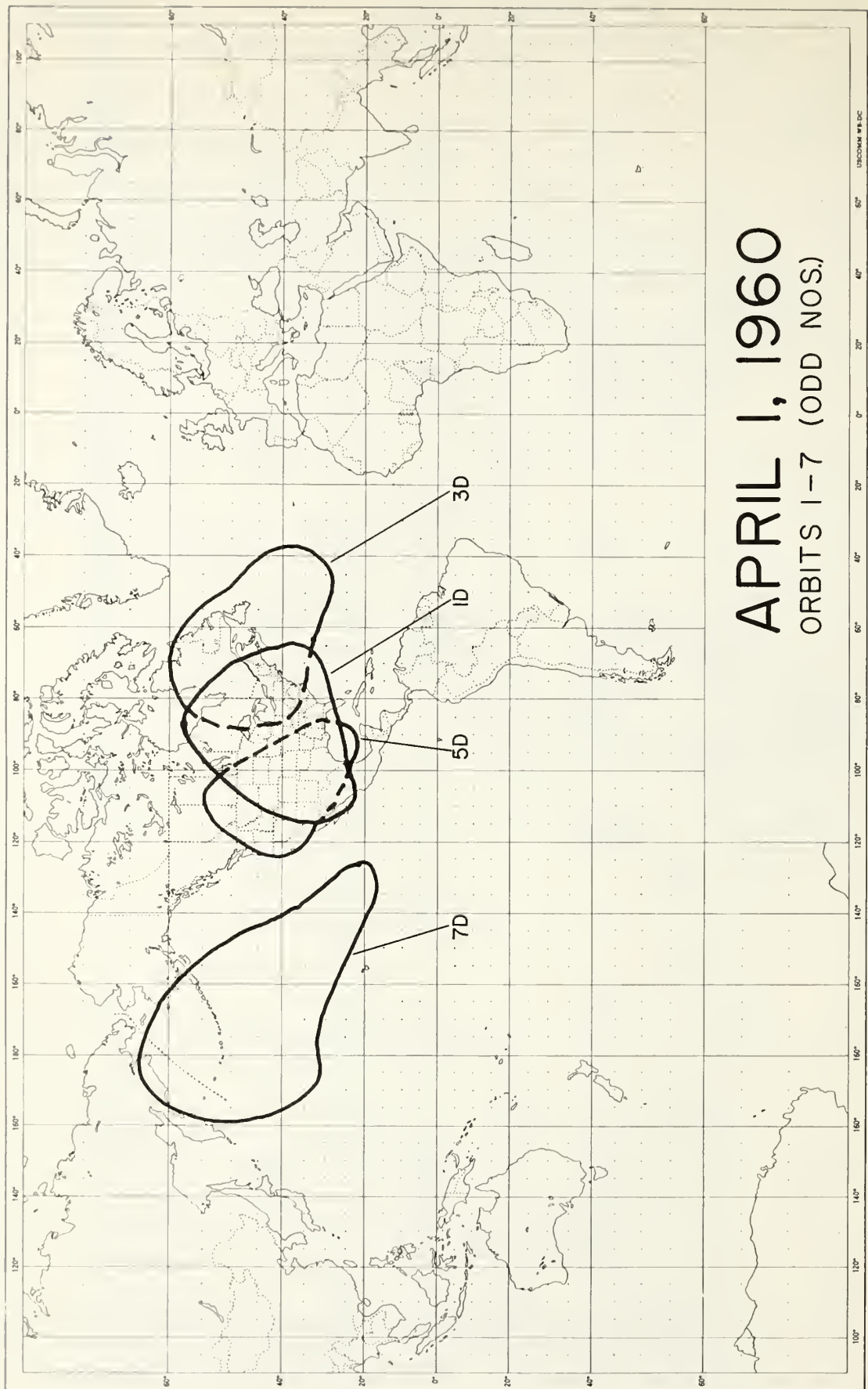
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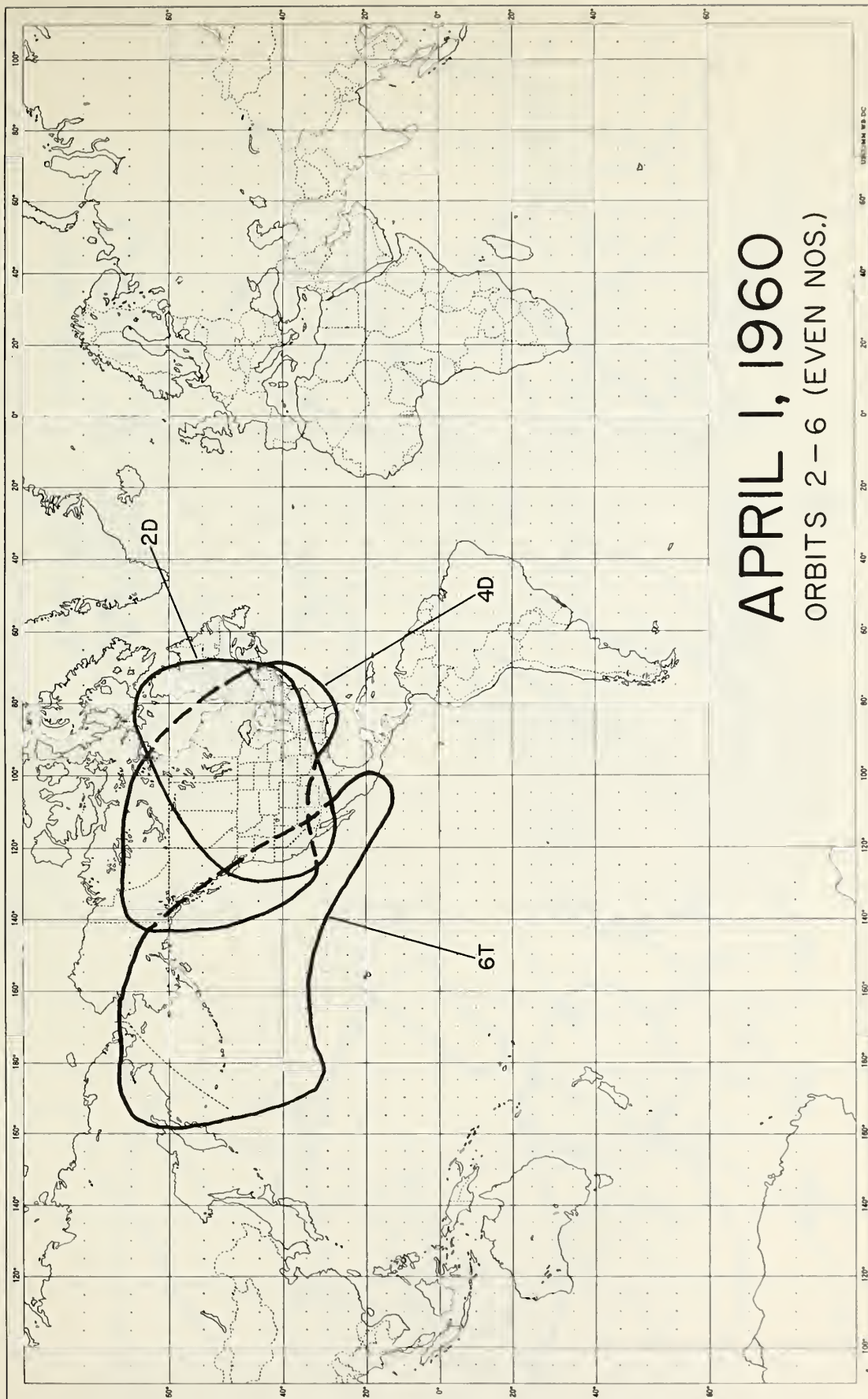
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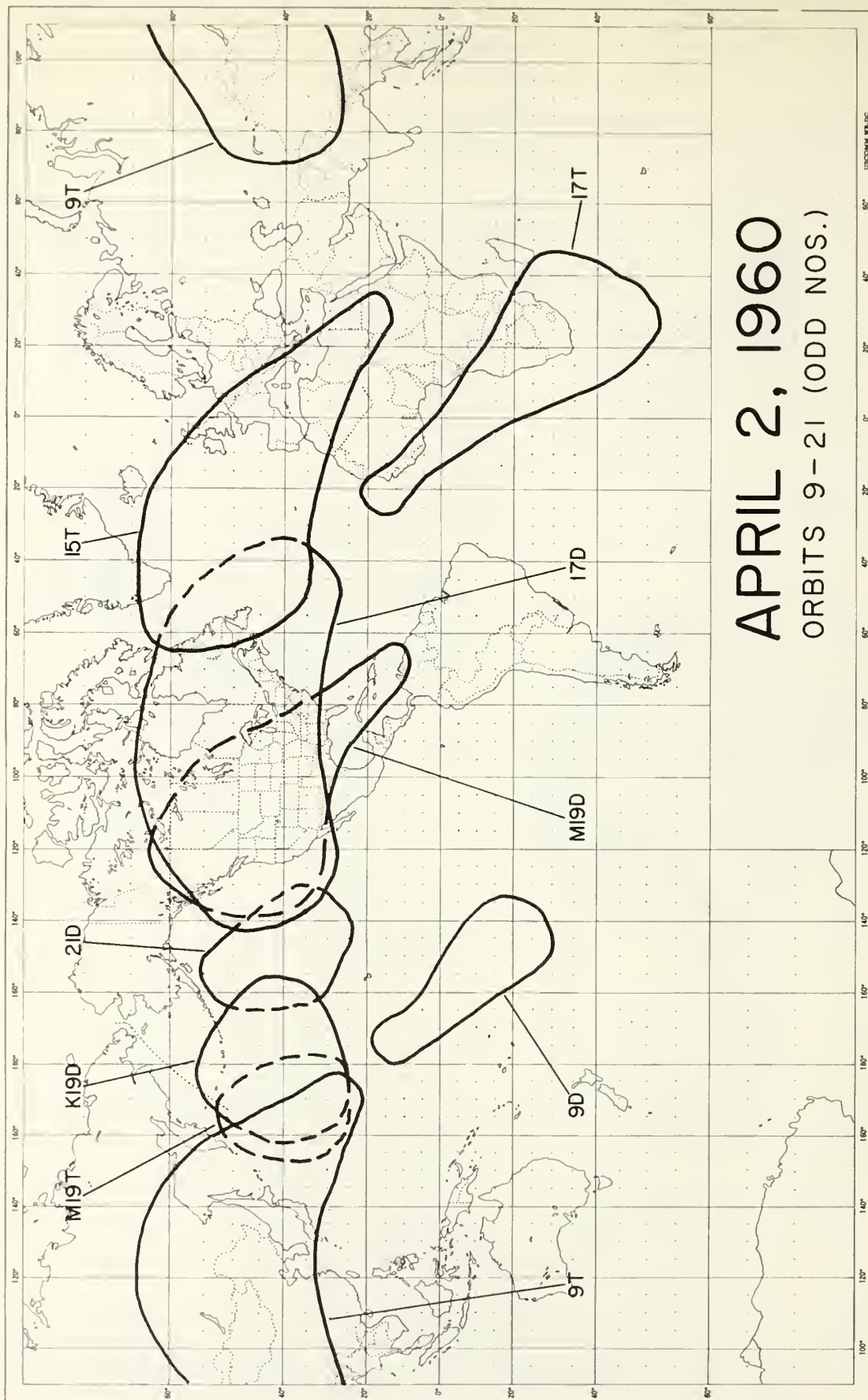
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133	0976	T	1	M	0974	T	1	0607	1351	31	31						5	6				11							1	2
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134	0987	D	2	M				D	2	00																				
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163	0995	D	2	K	0995	D	2	0609	0036	16	14		2							9									1	22
134	1004	T	1	M	1003	T	1	0609	1350	31	31						5	6				11							1	
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134	1006	T	1	M	1005	T	1	0609	1708	31	31						4	5				10								
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REEL	FILM LEGEND				PICTURE SEQUENCE DATA																							
	PASS	M	C	S	STARTING TIME				FRAME		GEOGRAPHICAL AREA COVERED																	LVBS
PASS					M	C	DATE	TIME	US	+	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
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135	1086	D	2	M				D	2			00																
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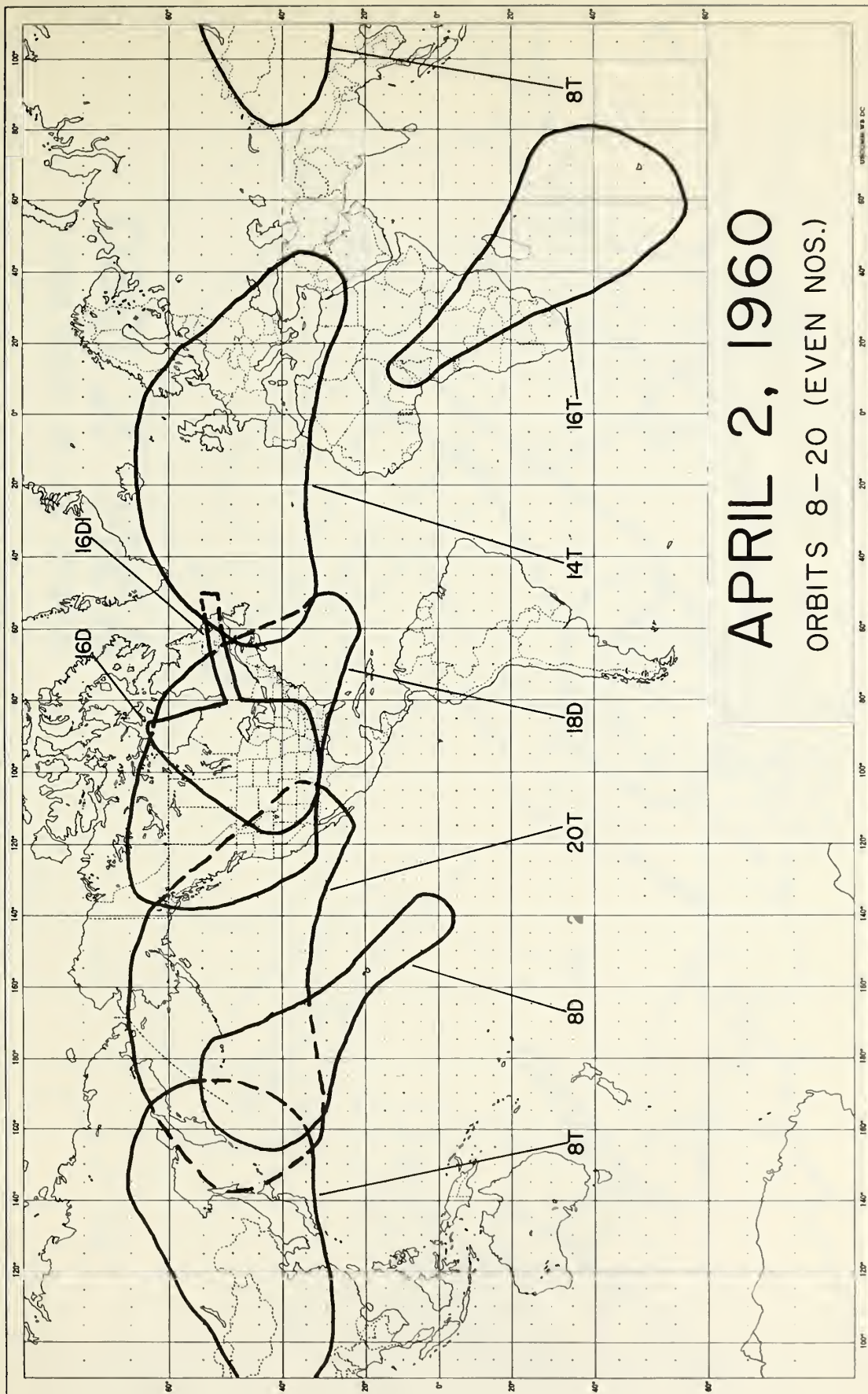


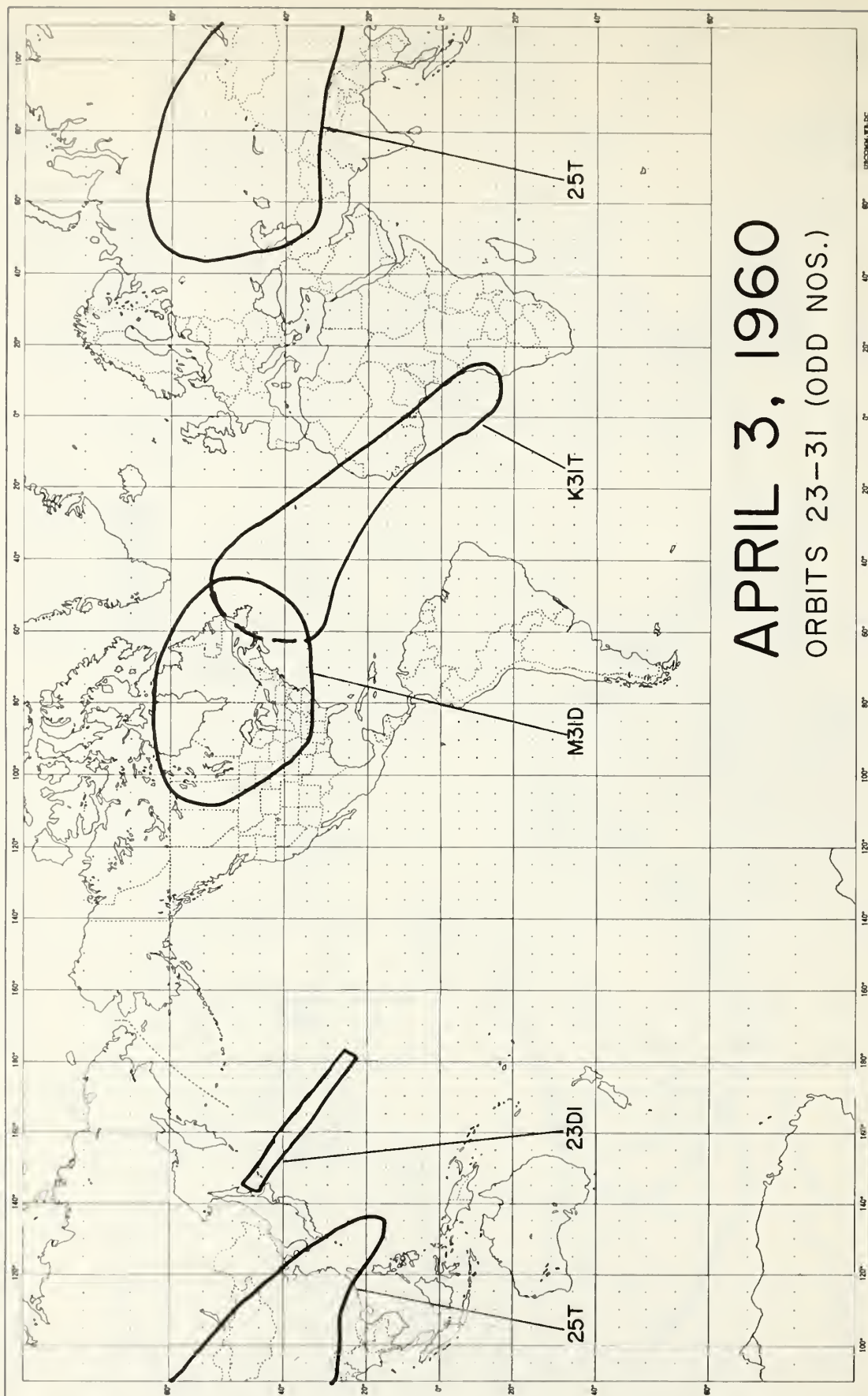






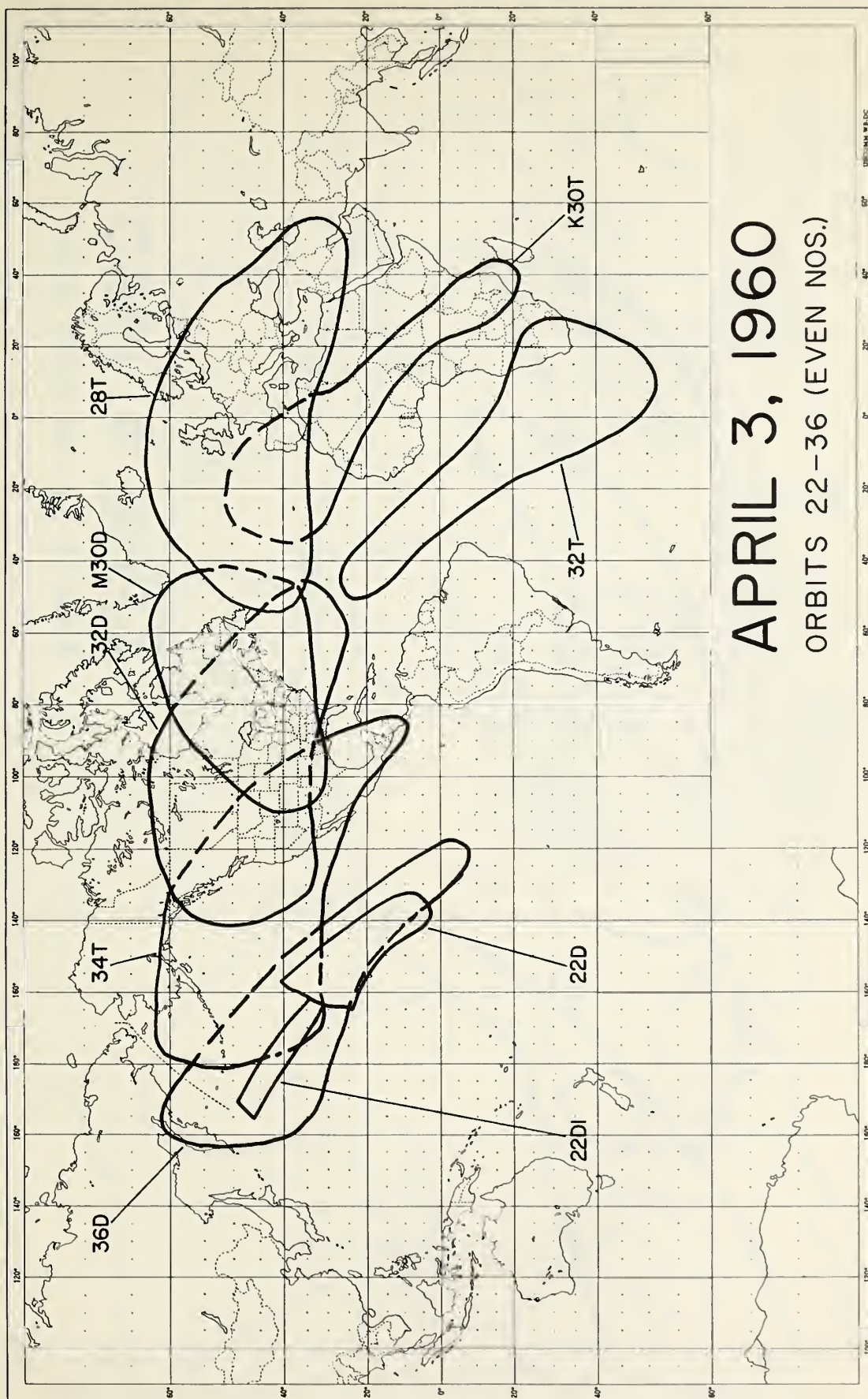
APRIL 2, 1960
ORBITS 9-21 (ODD NOS.)





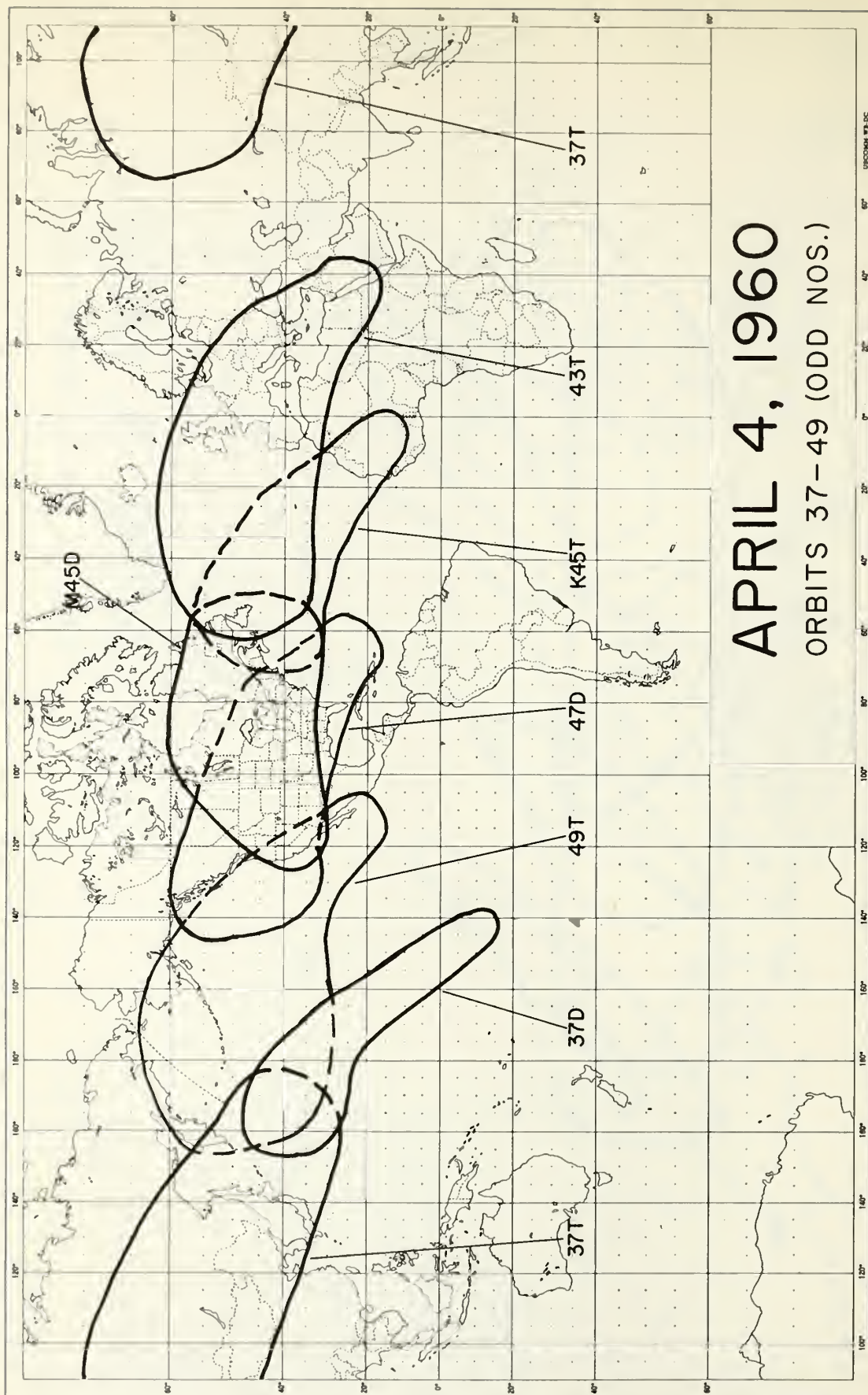
APRIL 3, 1960
ORBITS 23-31 (ODD NOS.)

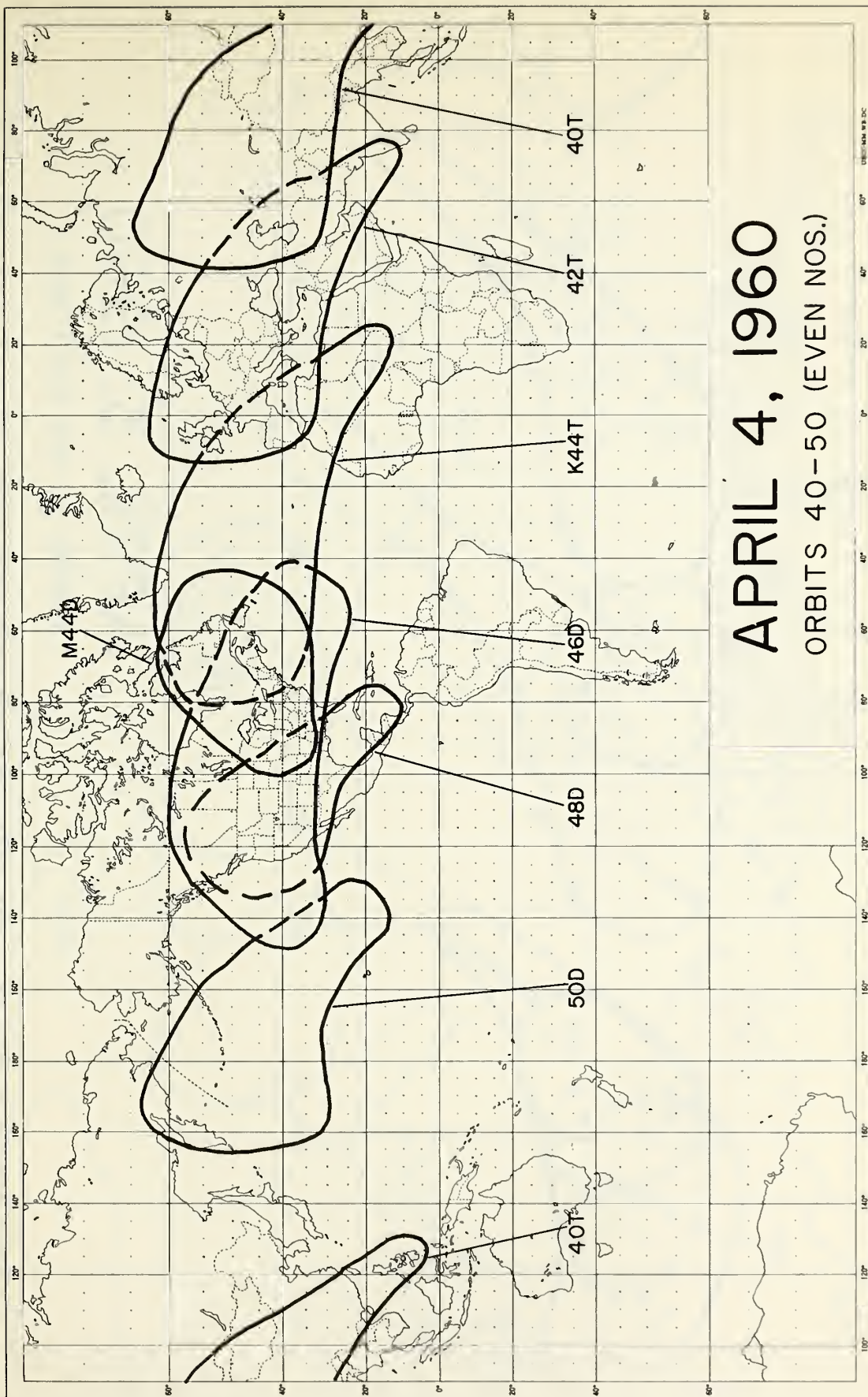
USCNAV 98.5C



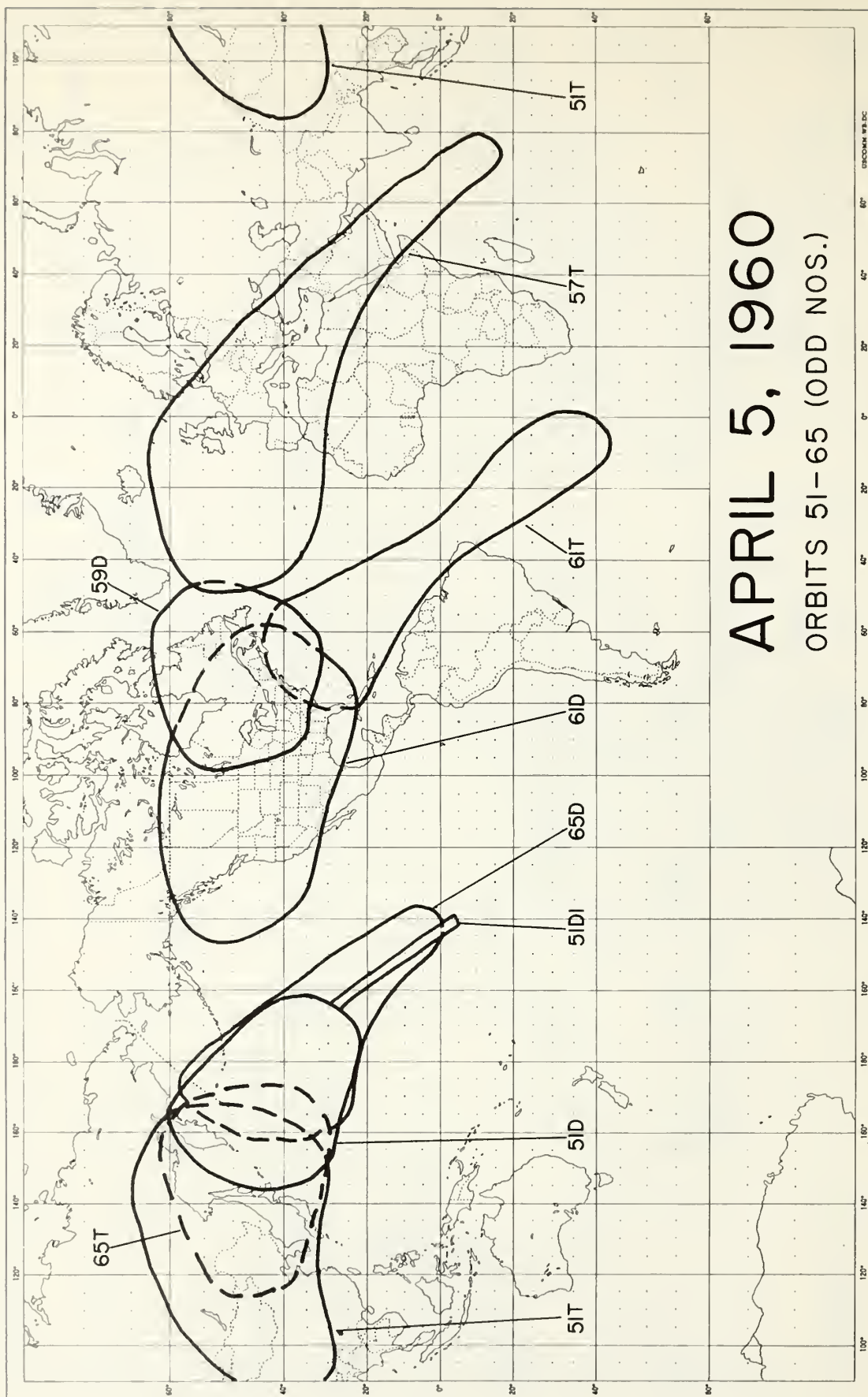
APRIL 3, 1960

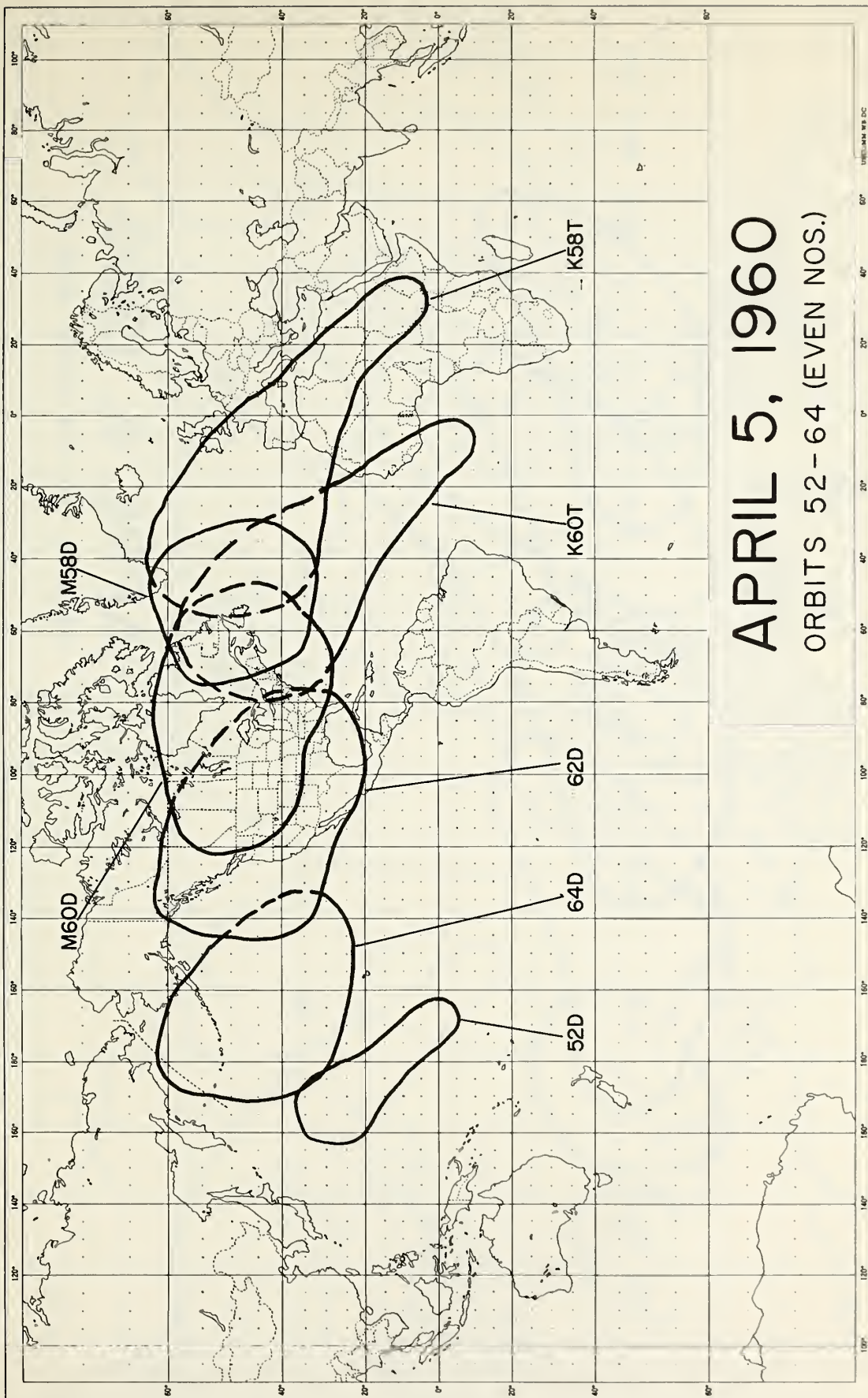
ORBITS 22-36 (EVEN NOS.)



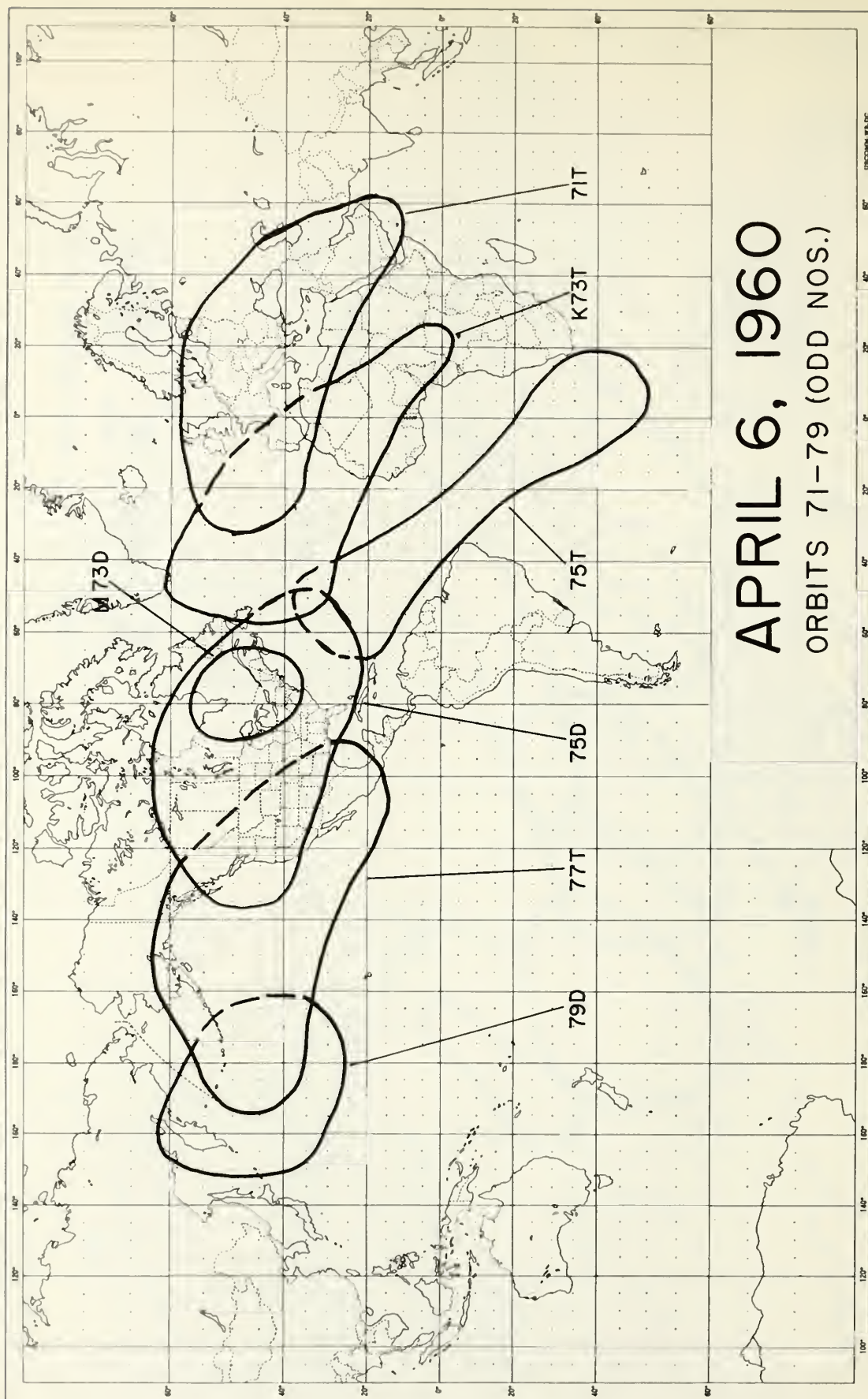


APRIL 4, 1960 ORBITS 40-50 (EVEN NOS.)



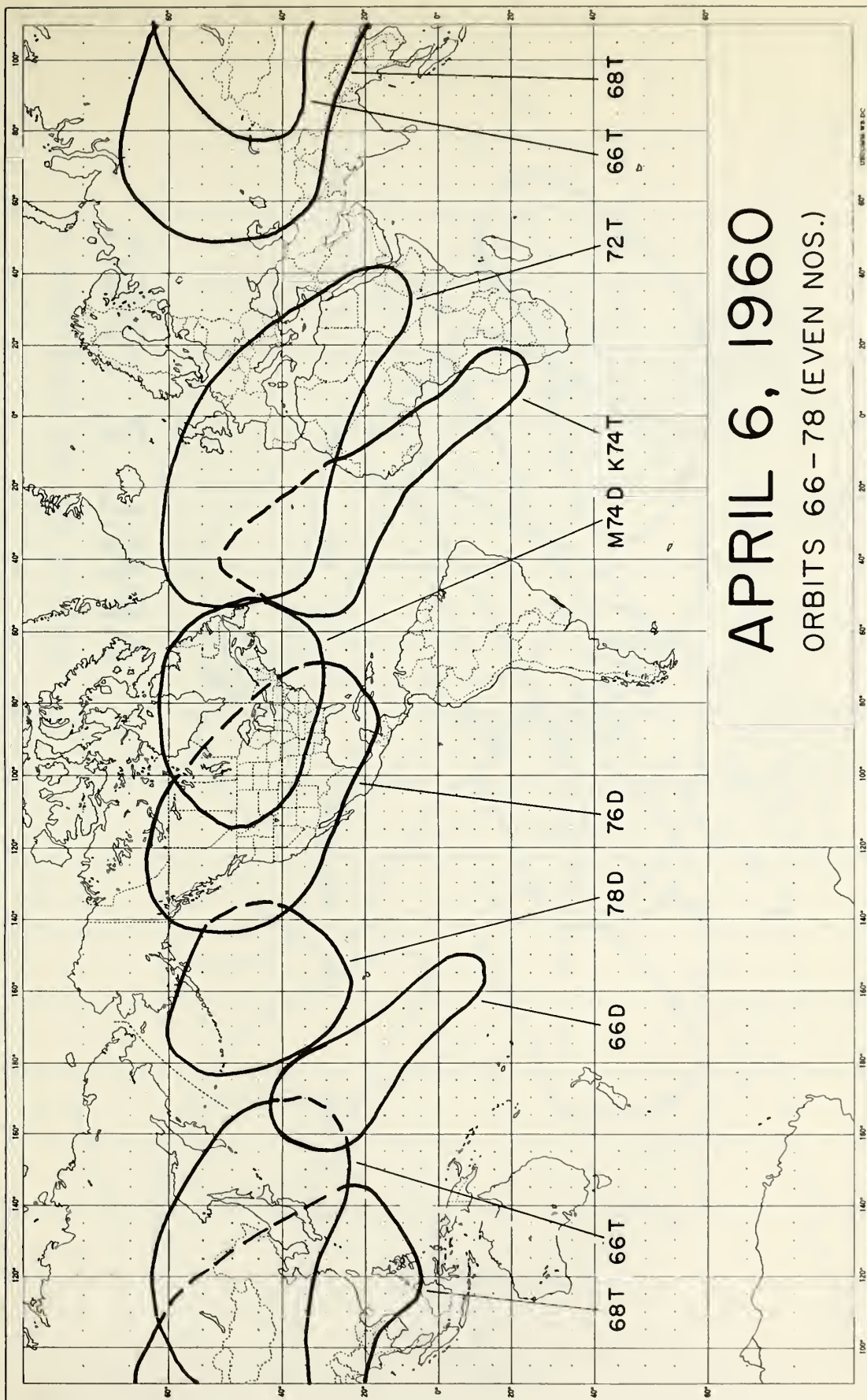


APRIL 5, 1960
ORBITS 52 - 64 (EVEN NOS.)



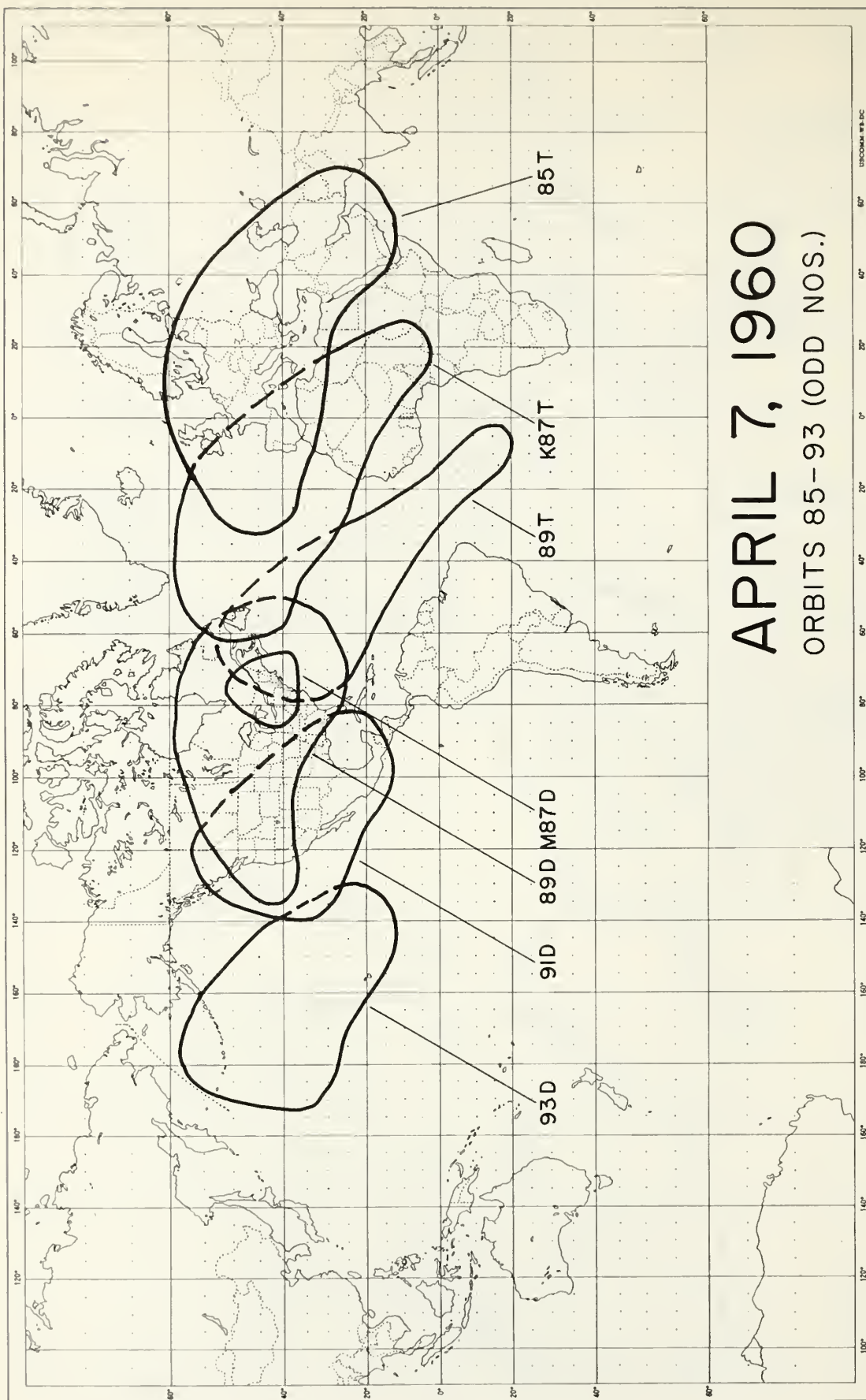
APRIL 6, 1960
ORBITS 71-79 (ODD NOS.)

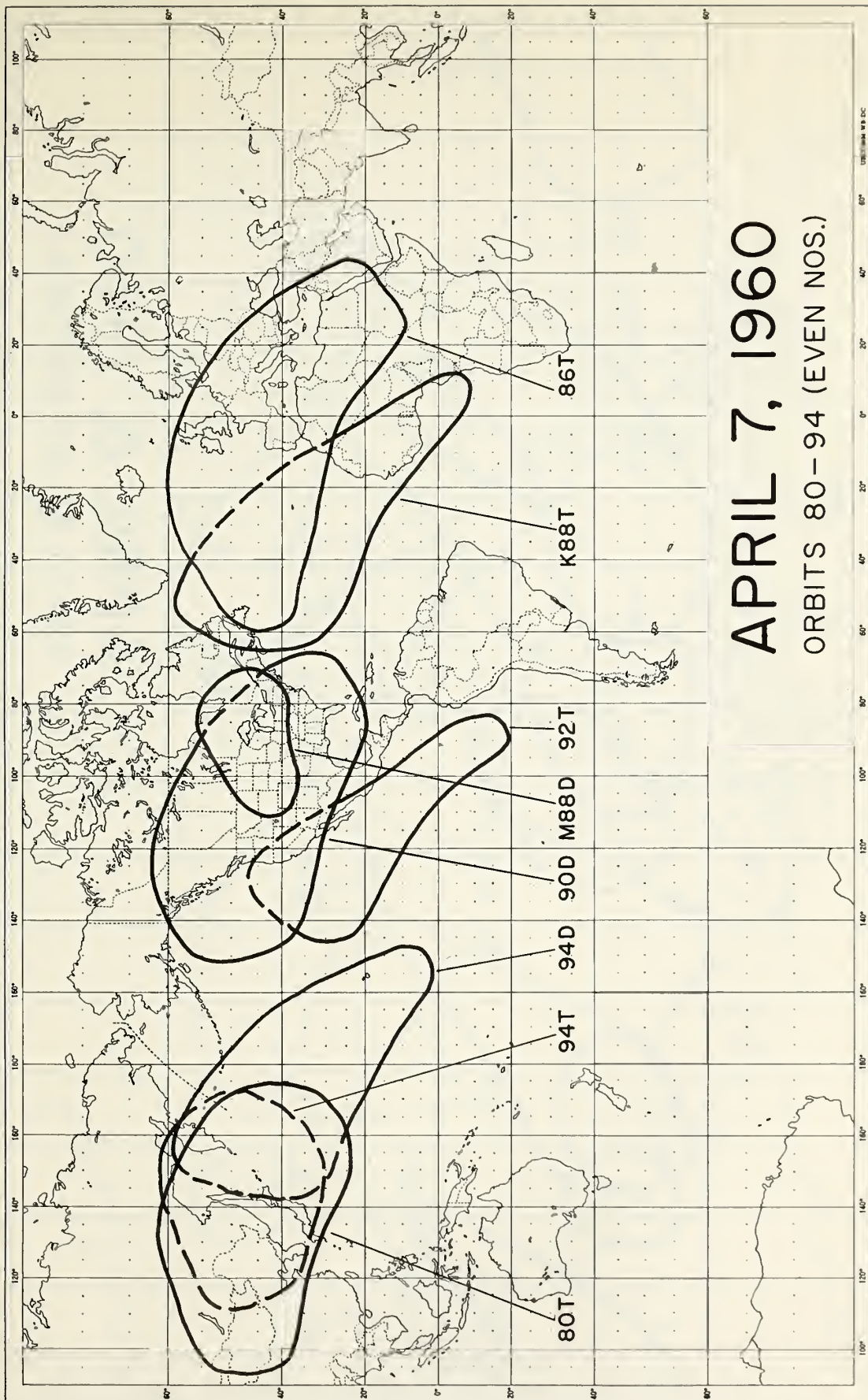
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APRIL 6, 1960

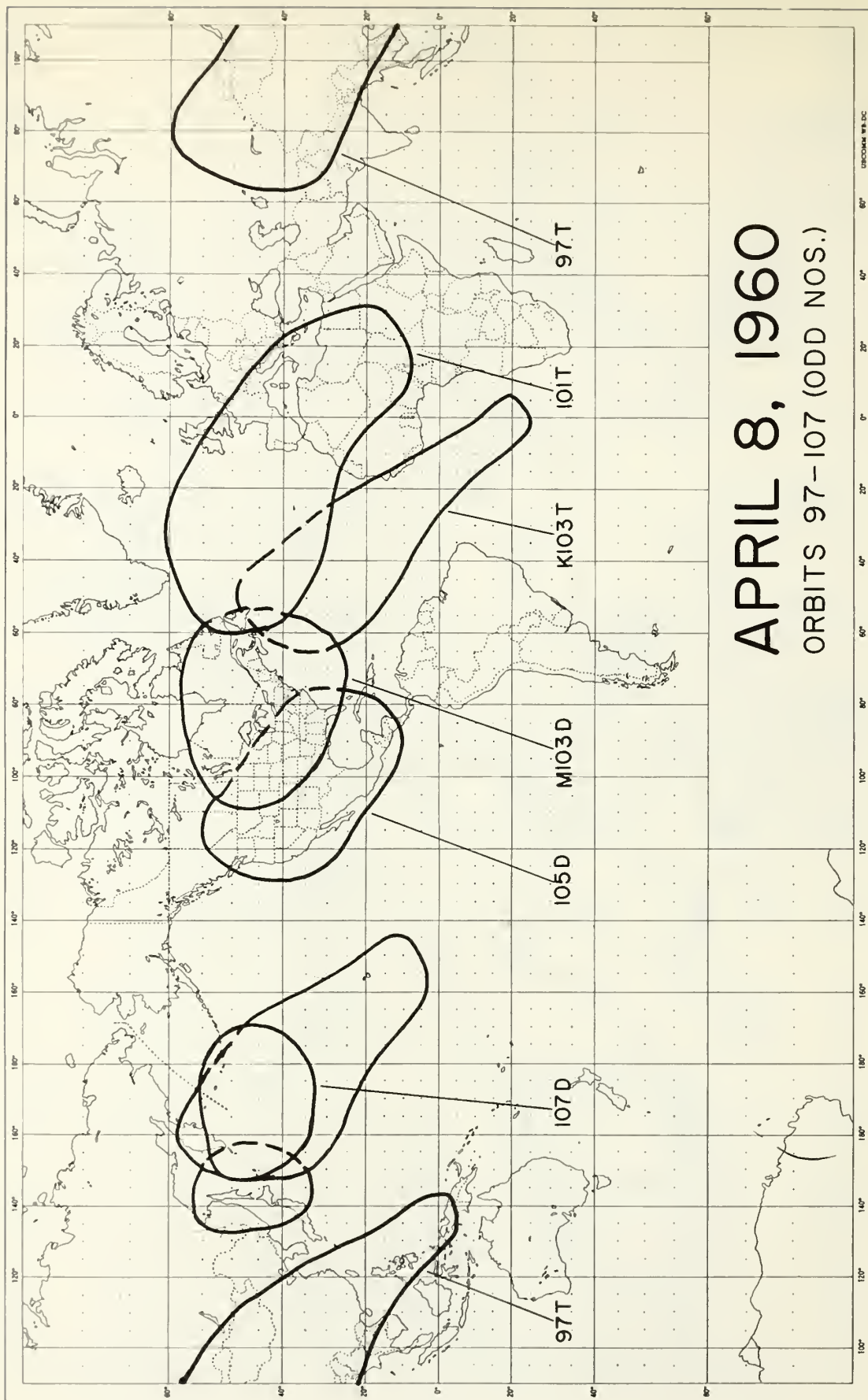
ORBITS 66-78 (EVEN NOS.)



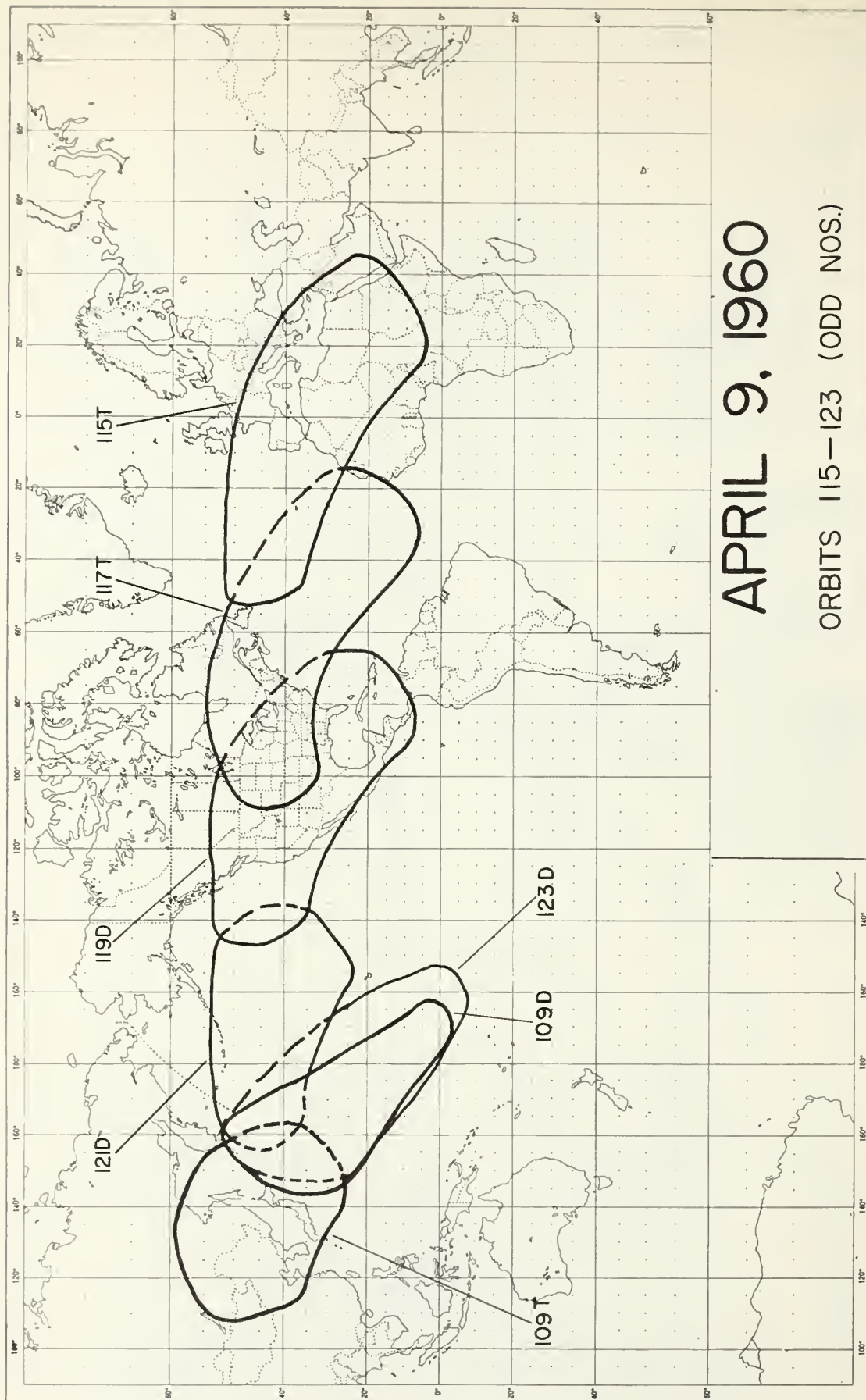


APRIL 7, 1960

ORBITS 80-94 (EVEN NOS.)

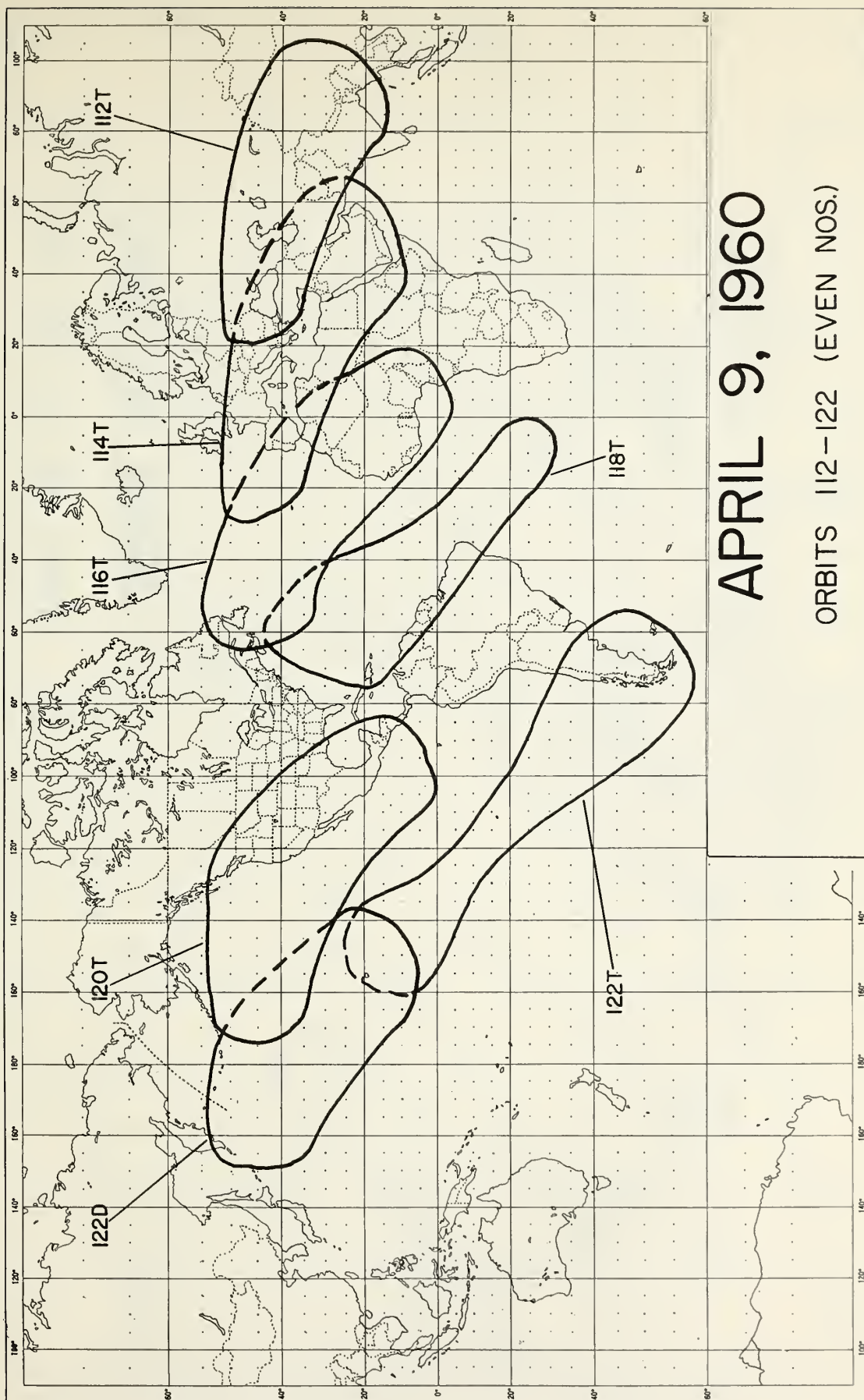


APRIL 8, 1960
ORBITS 97-107 (ODD NOS.)



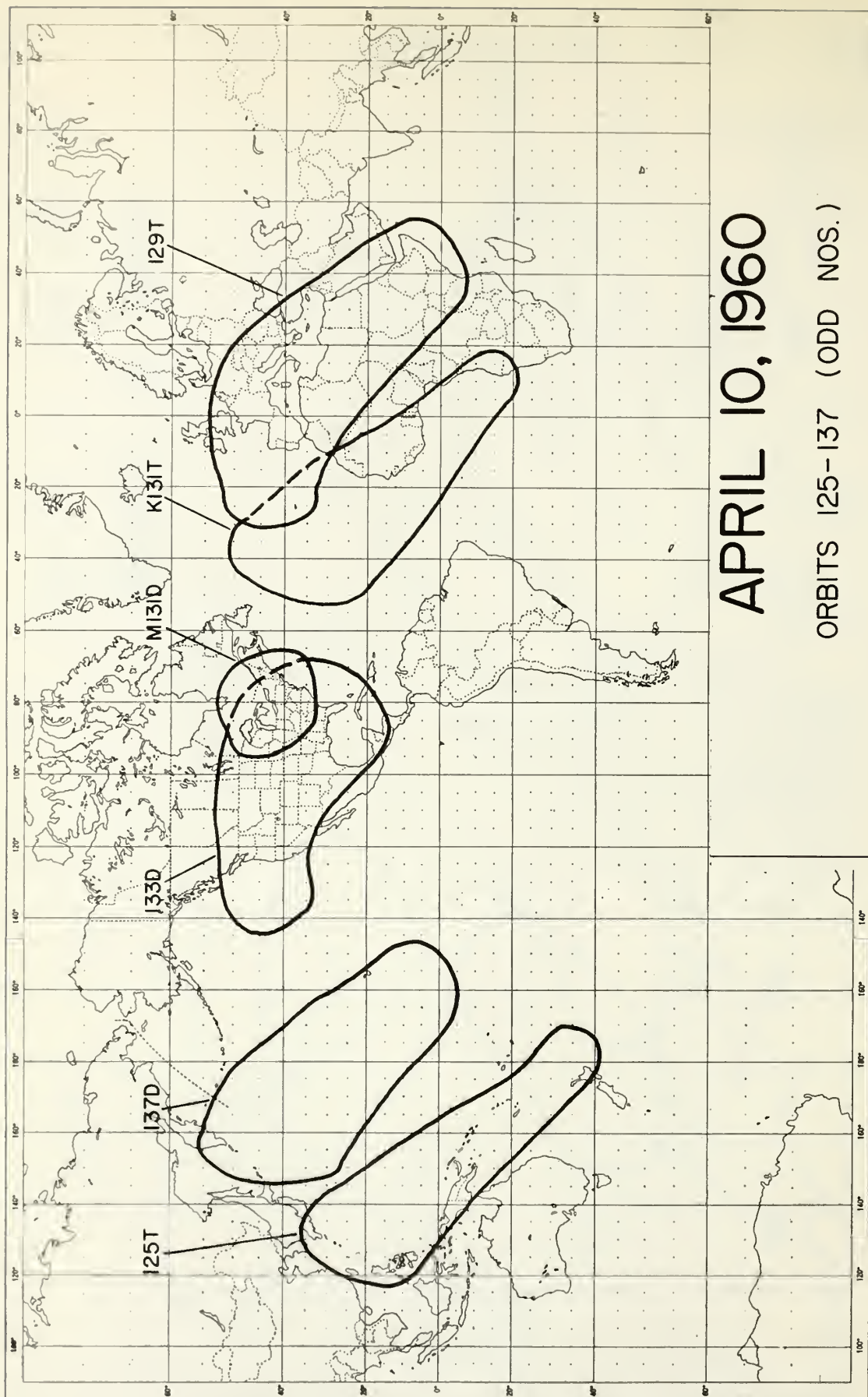
APRIL 9, 1960

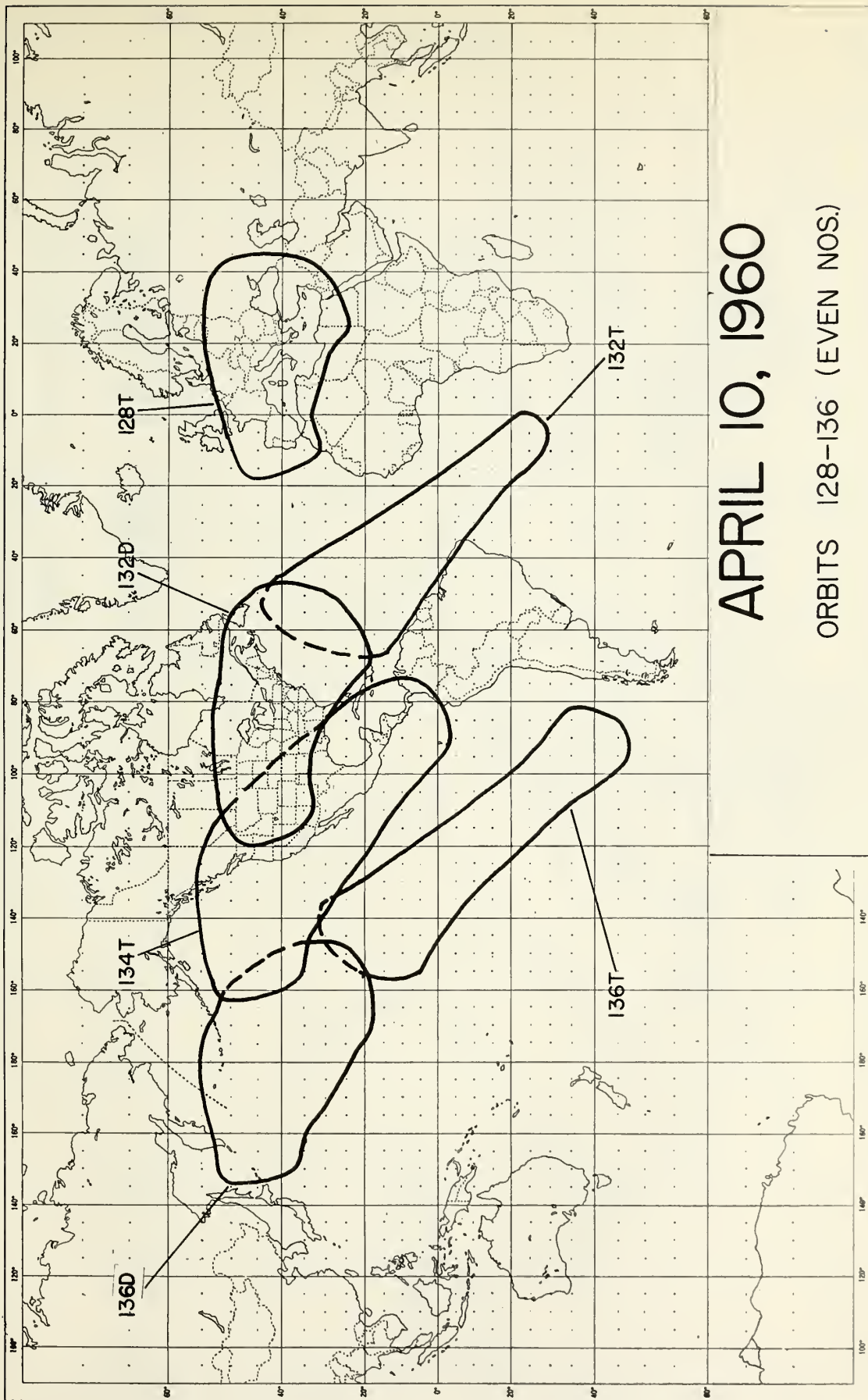
ORBITS 115-123 (ODD NOS.)



APRIL 9, 1960

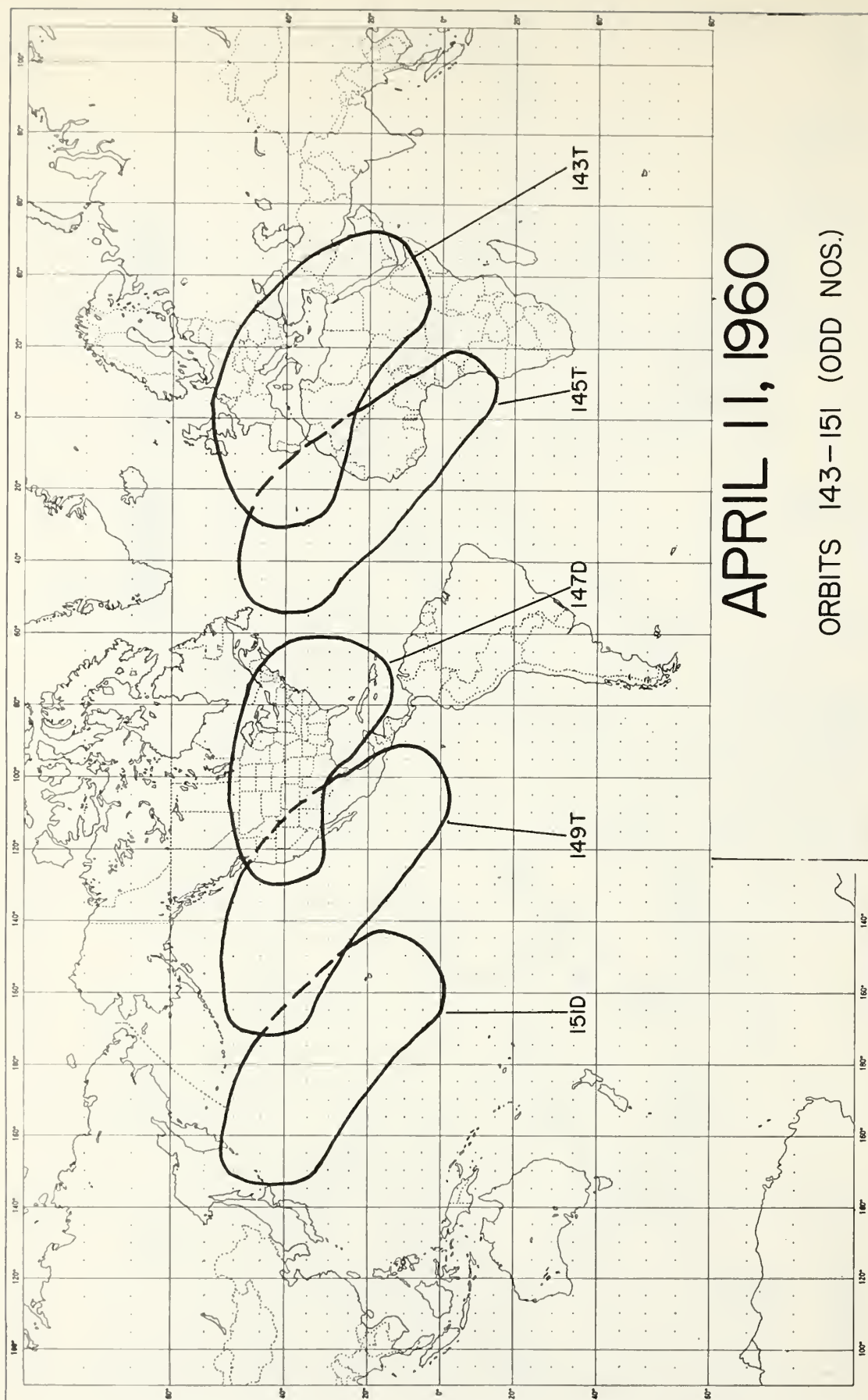
ORBITS 112-122 (EVEN NOS.)

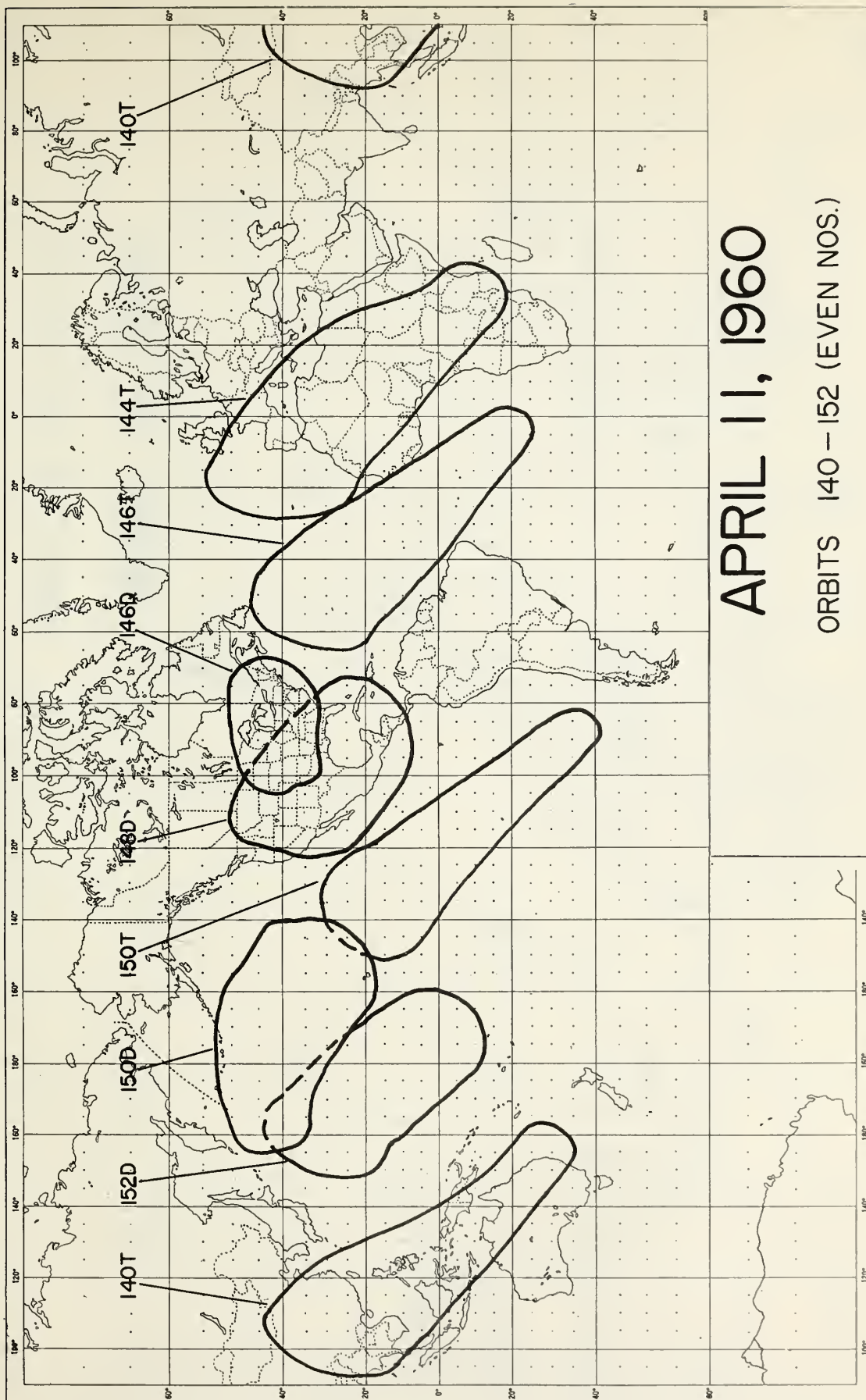




APRIL 10, 1960

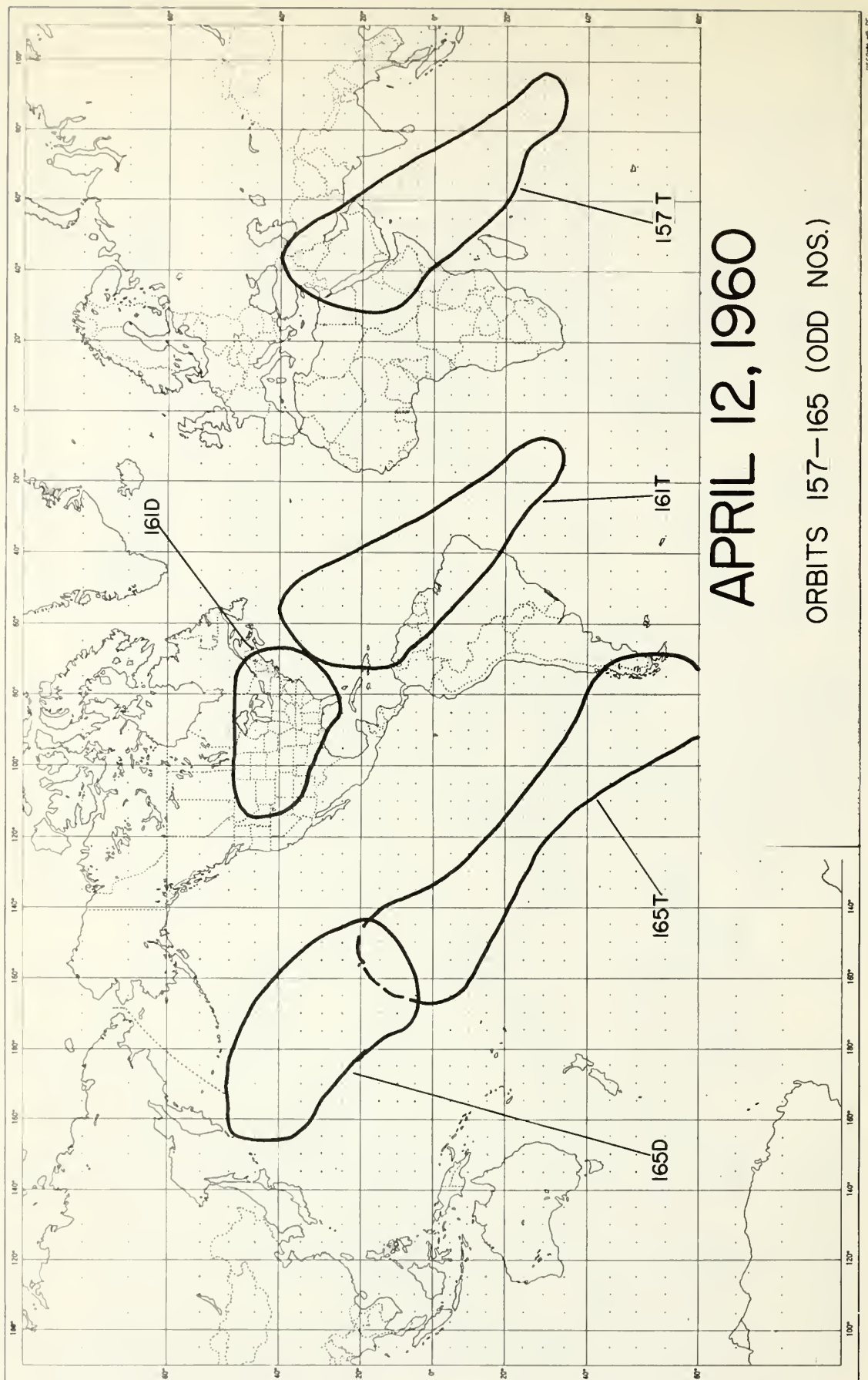
ORBITS 128-136 (EVEN NOS.)

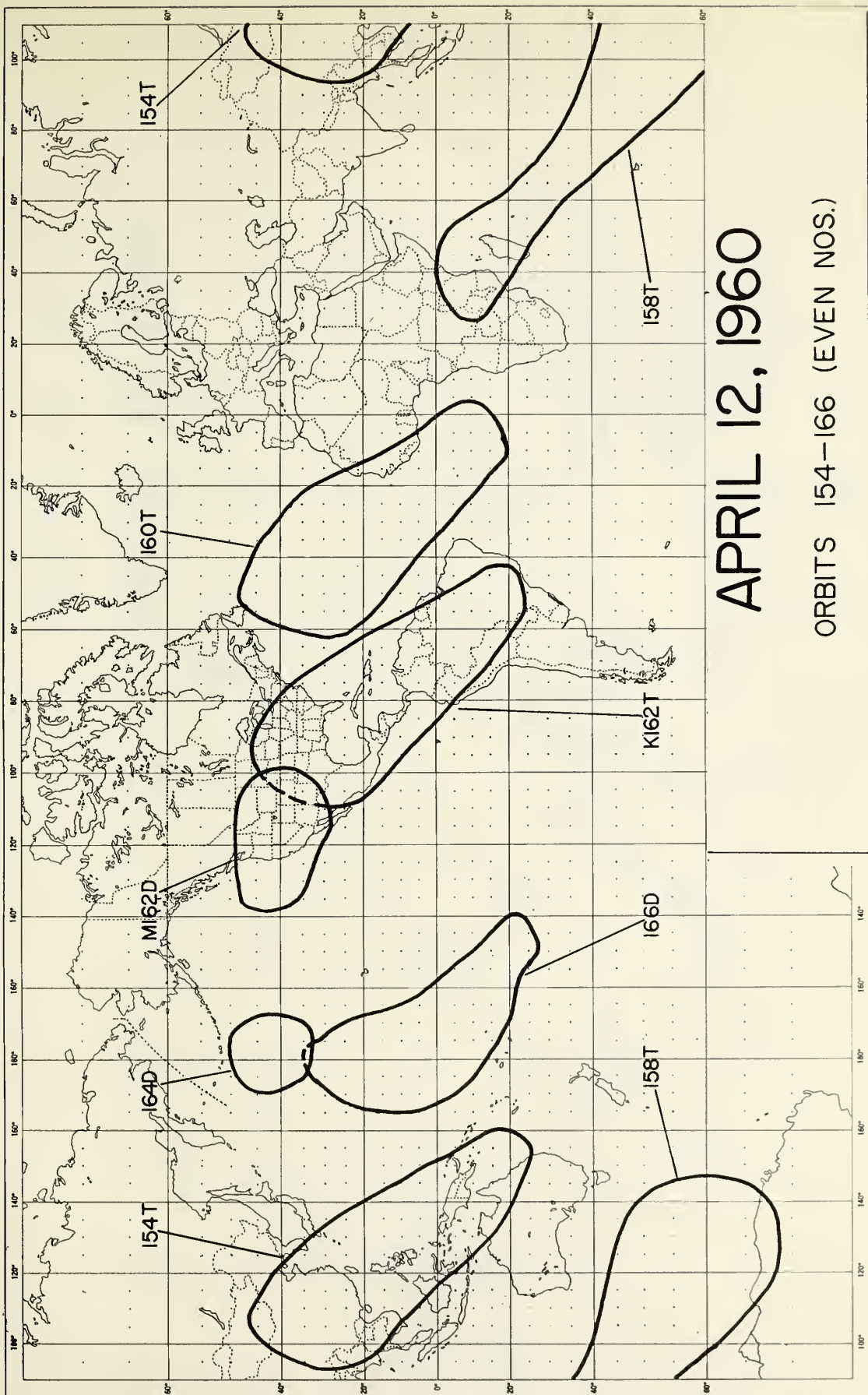


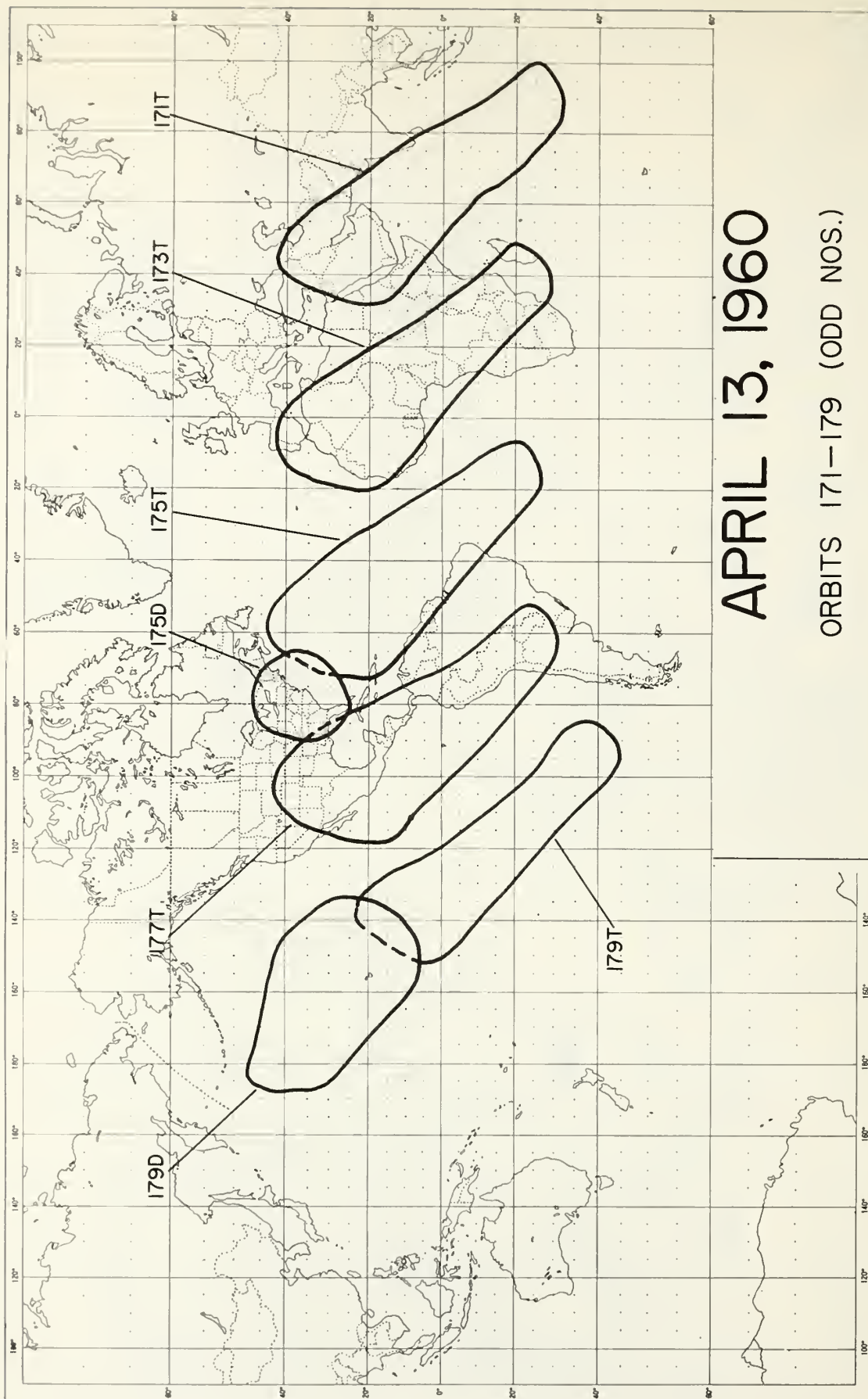


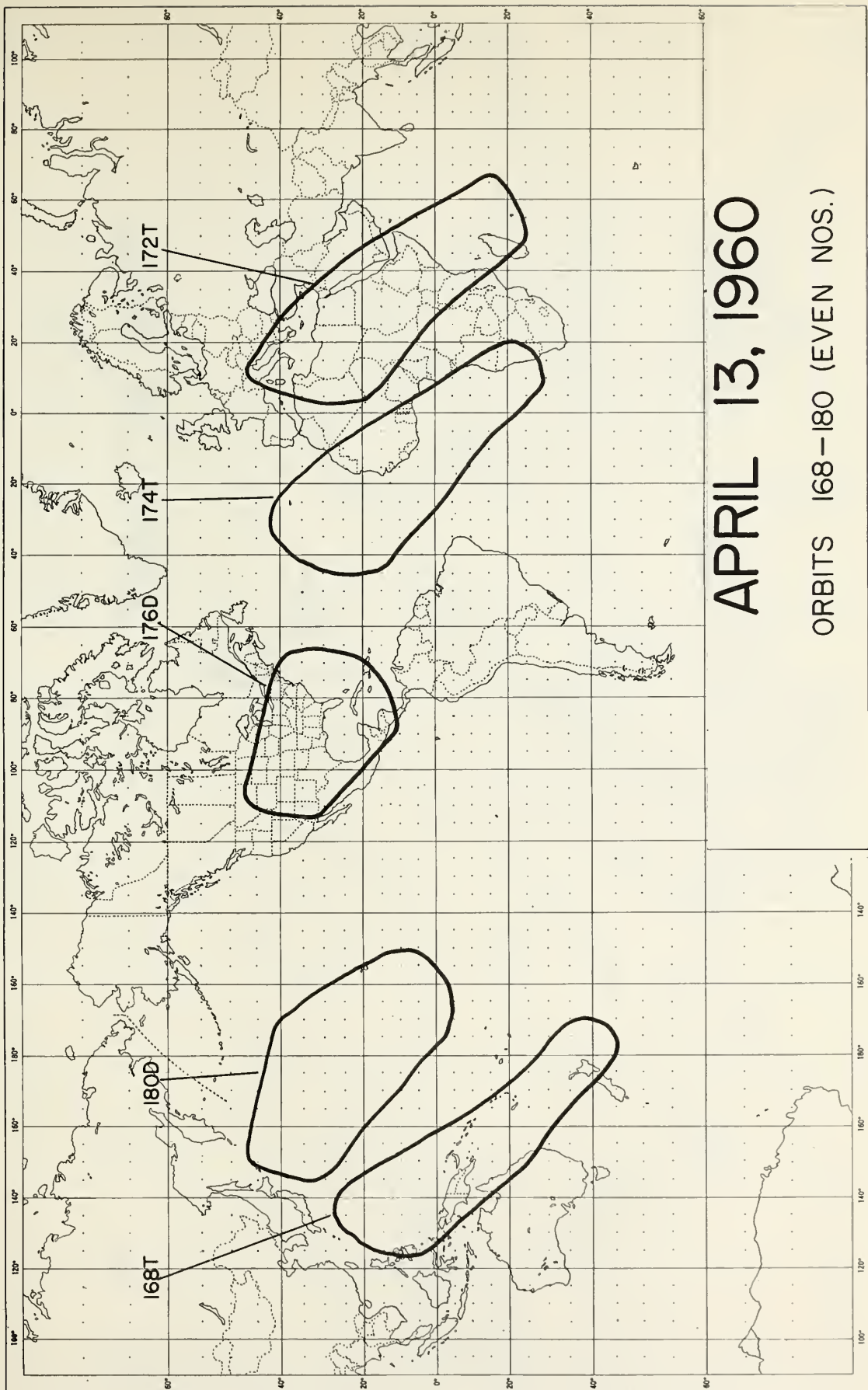
APRIL 11, 1960

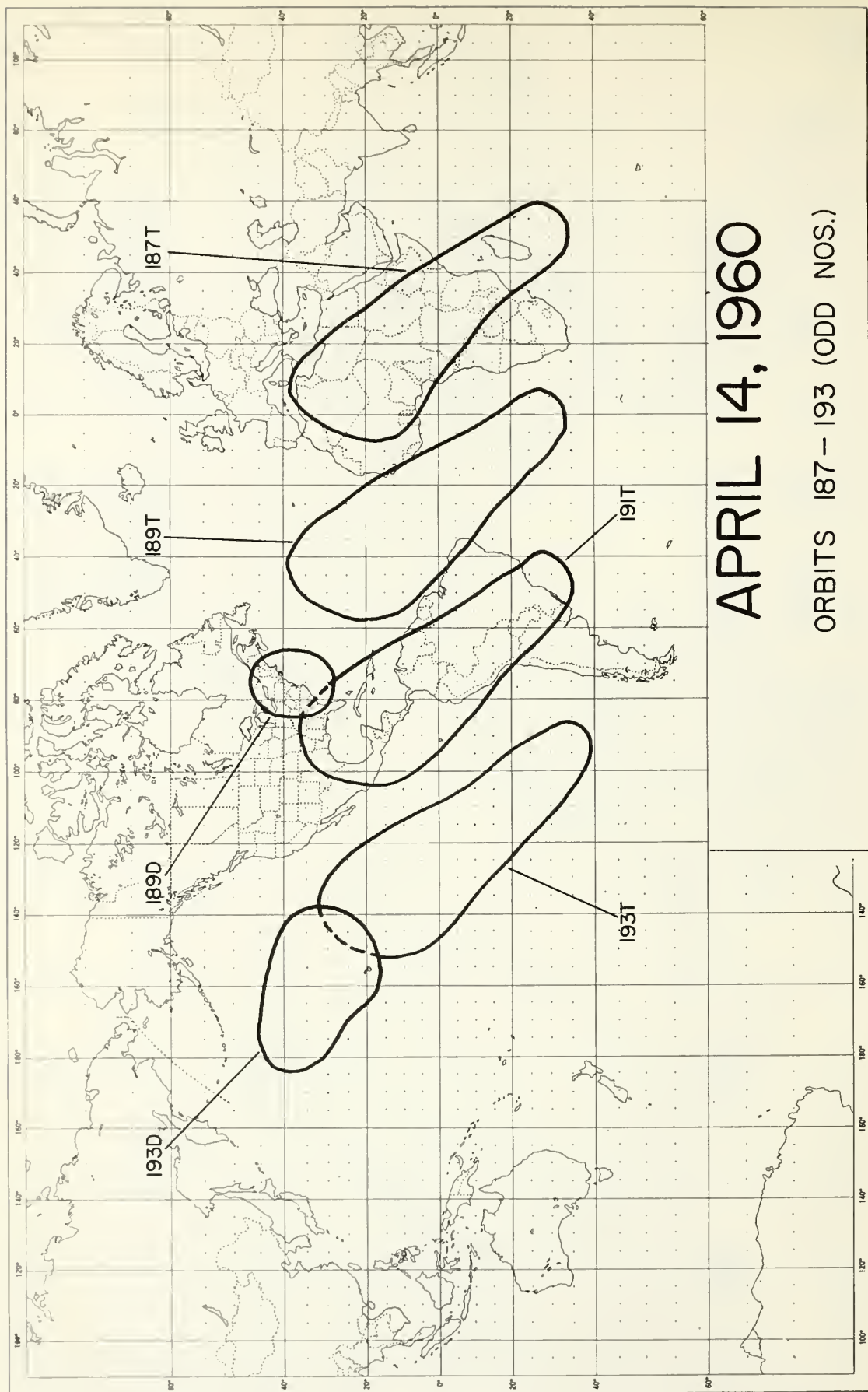
ORBITS 140 - 152 (EVEN NOS.)

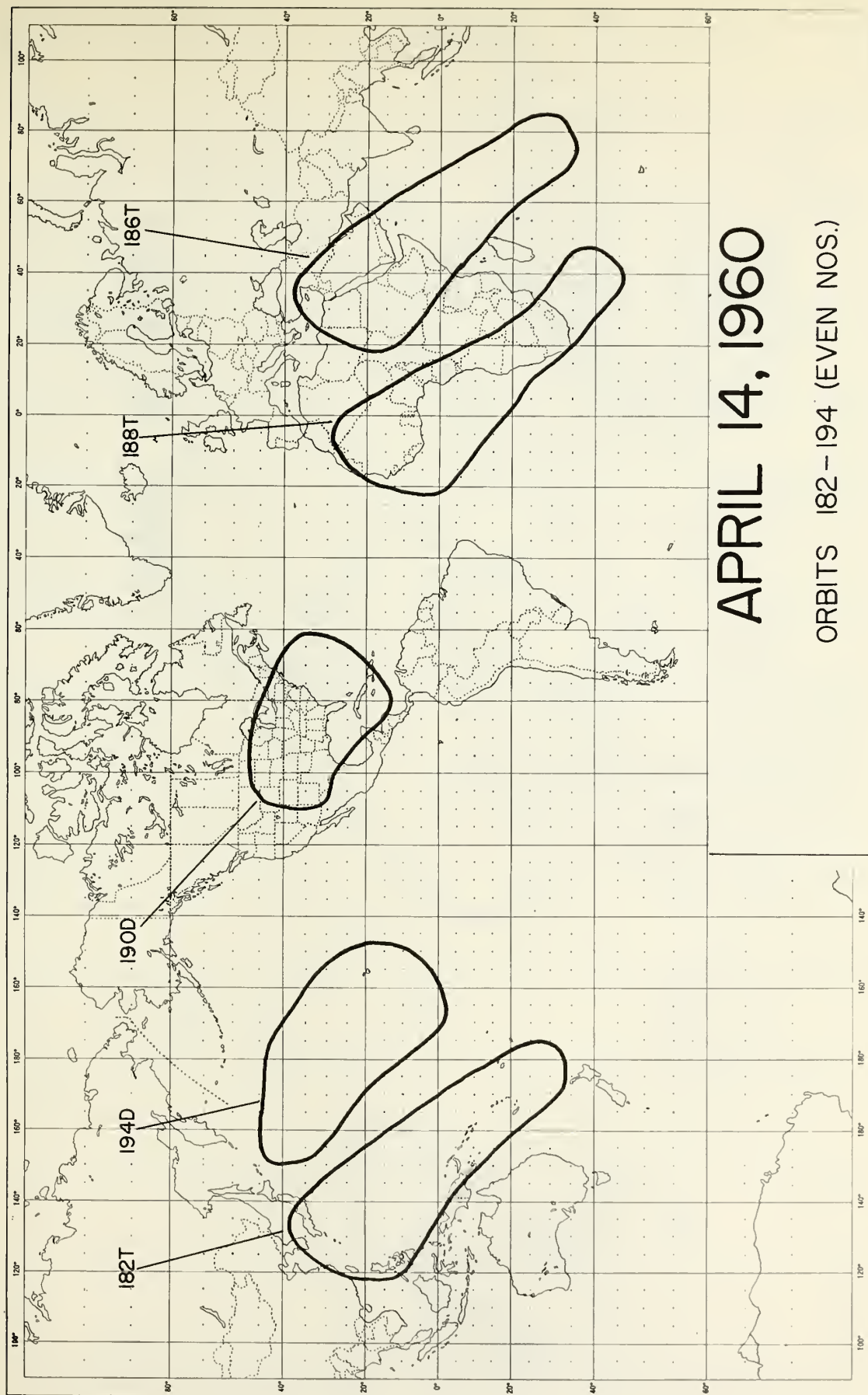






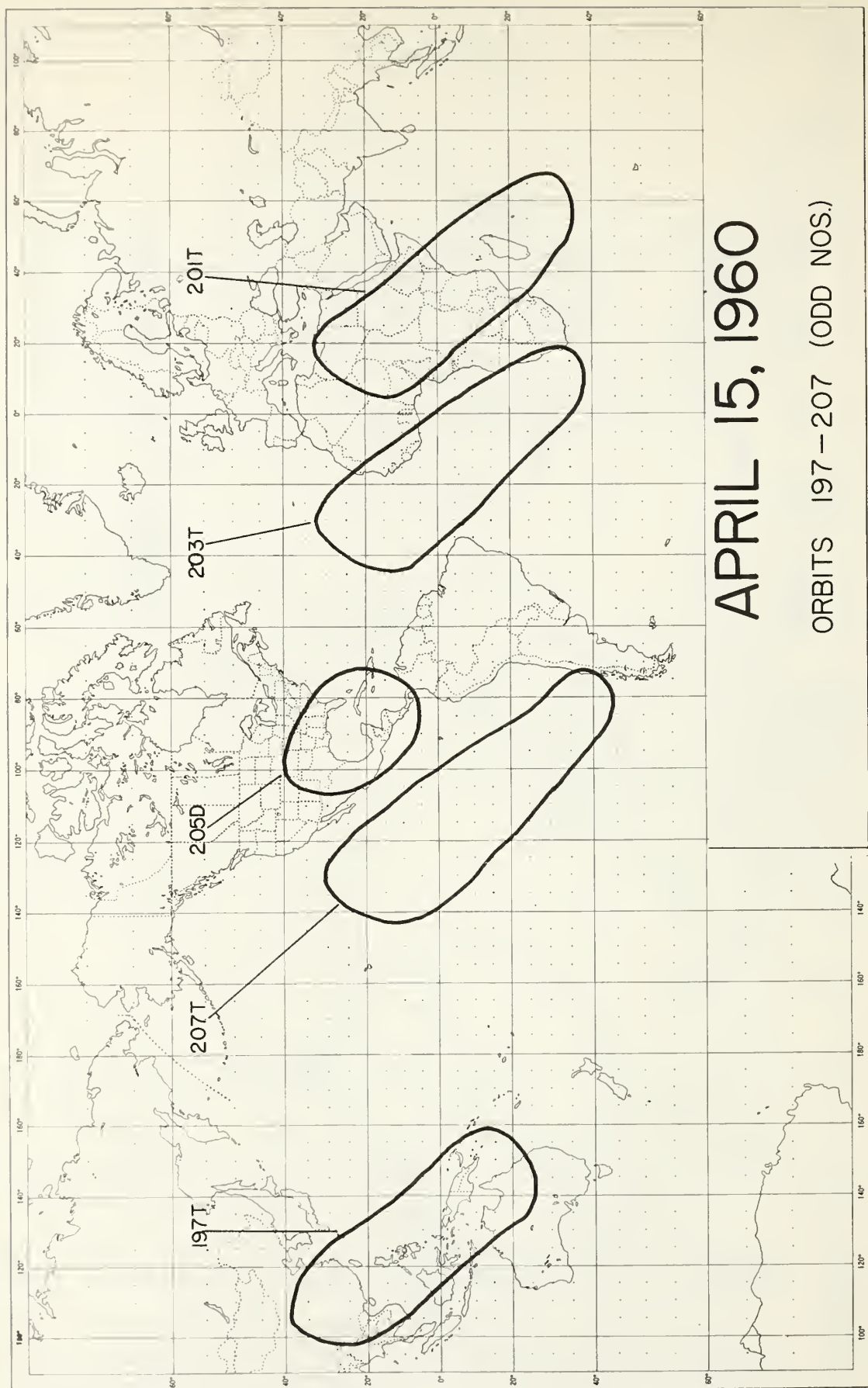


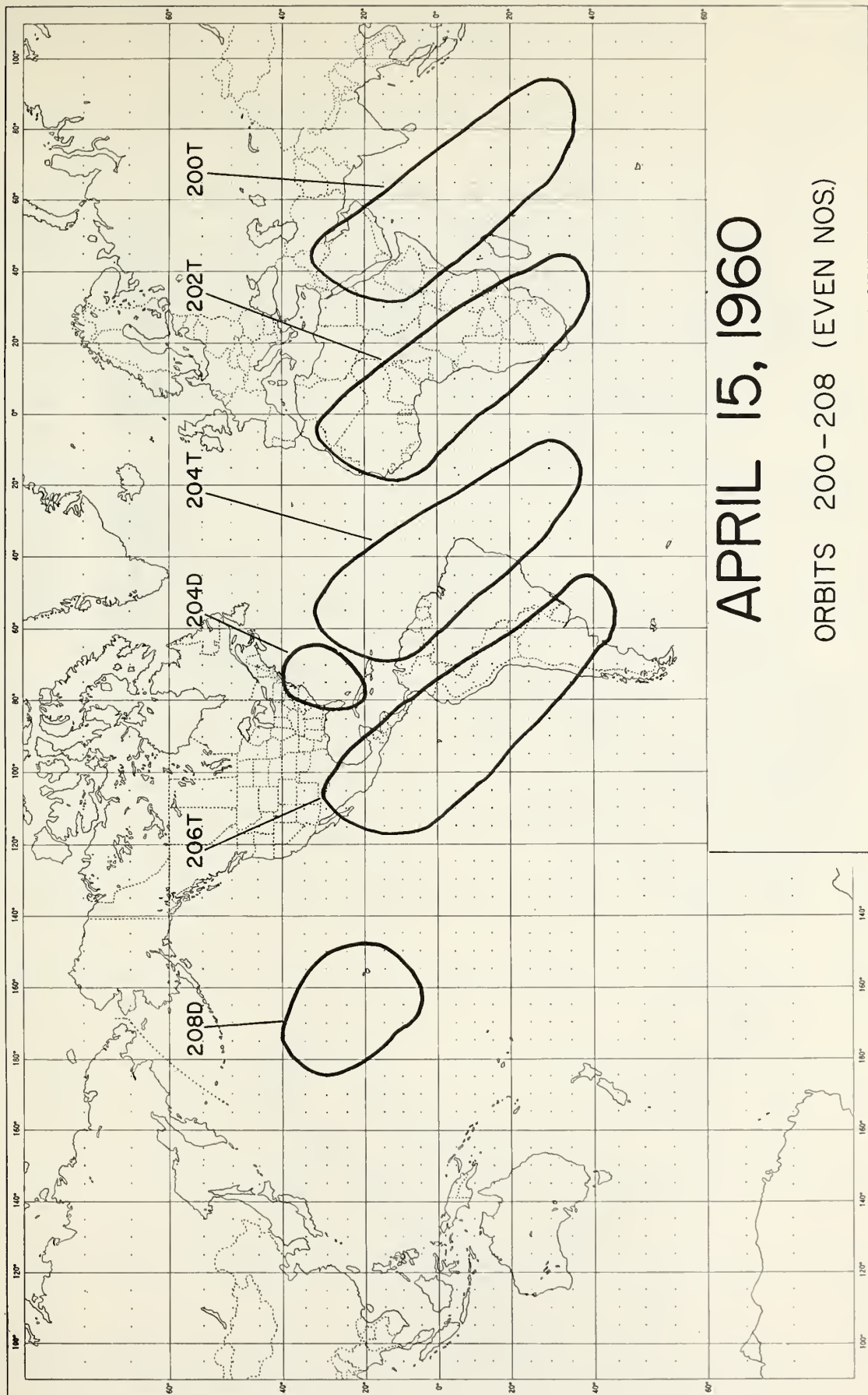




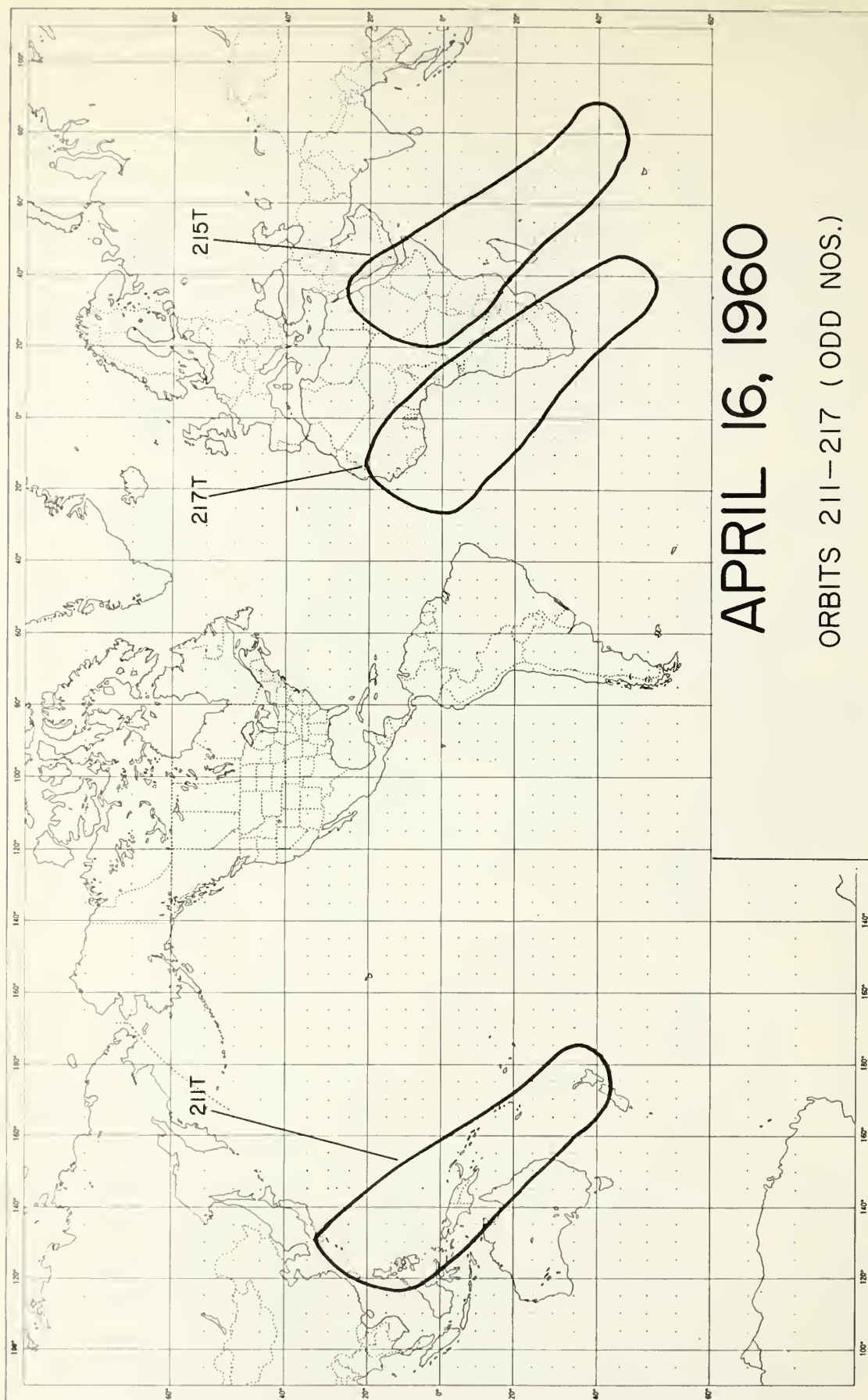
APRIL 14, 1960

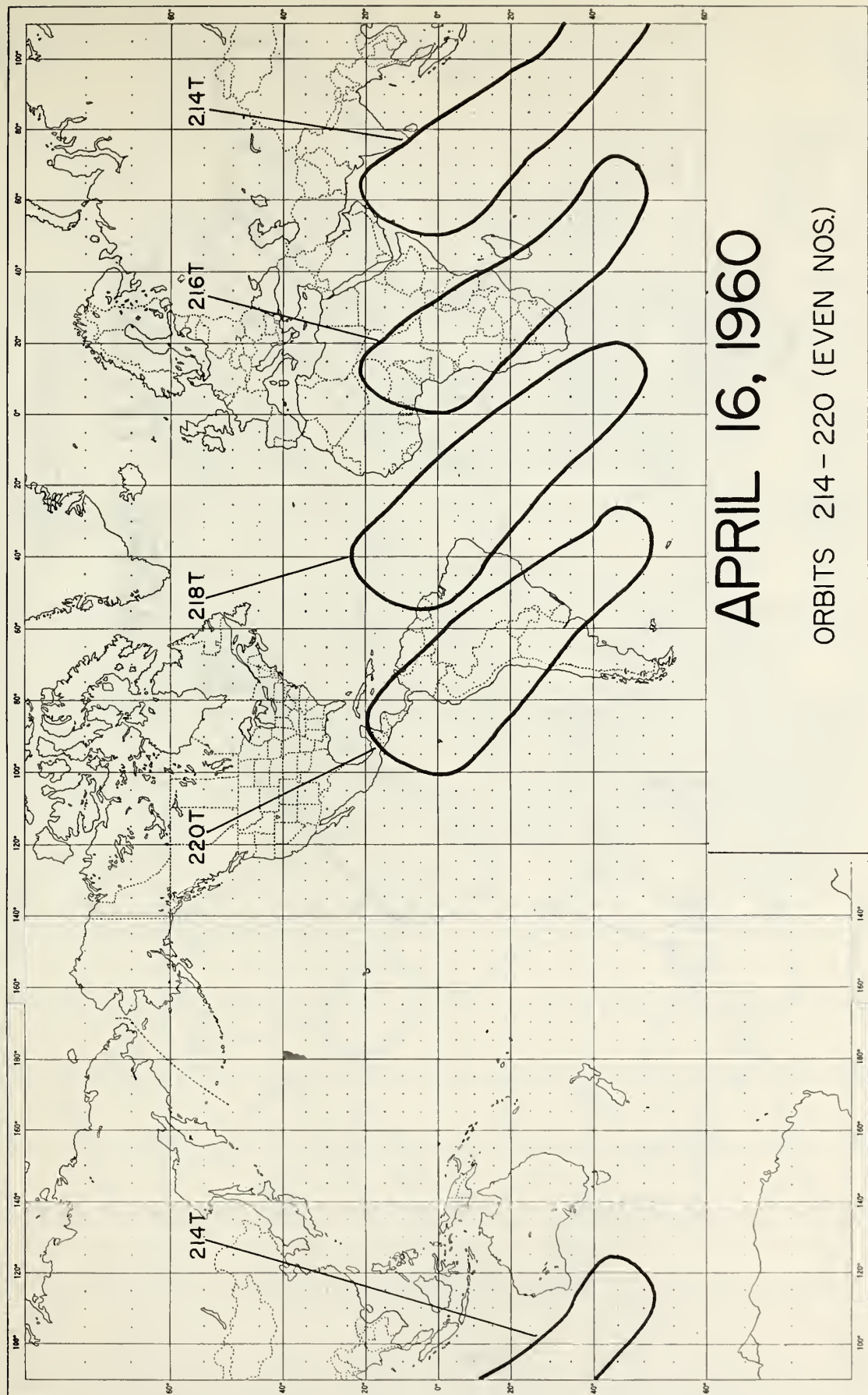
ORBITS 182 - 194 (EVEN NOS.)





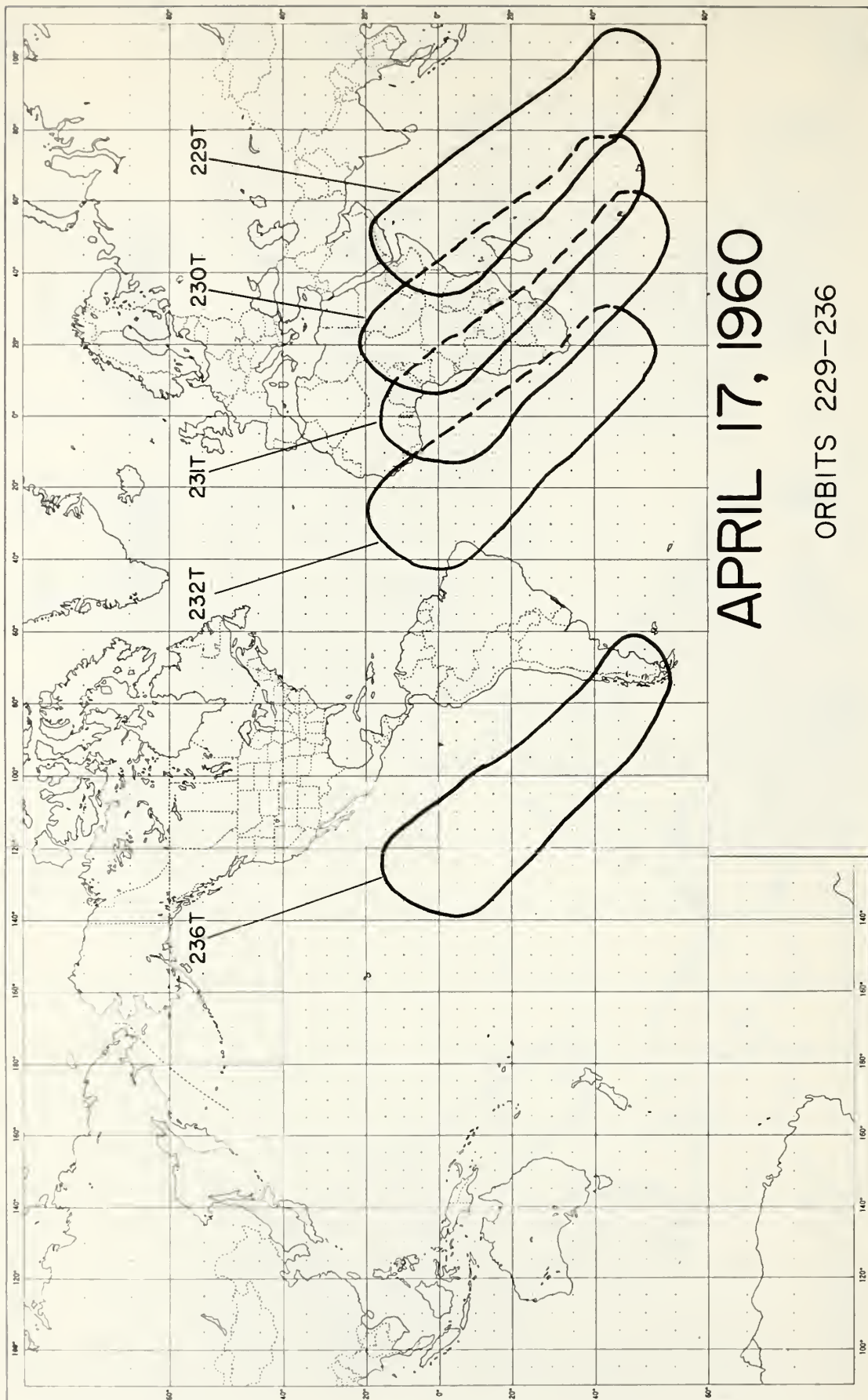
U.S. GOVERNMENT PRINTING OFFICE

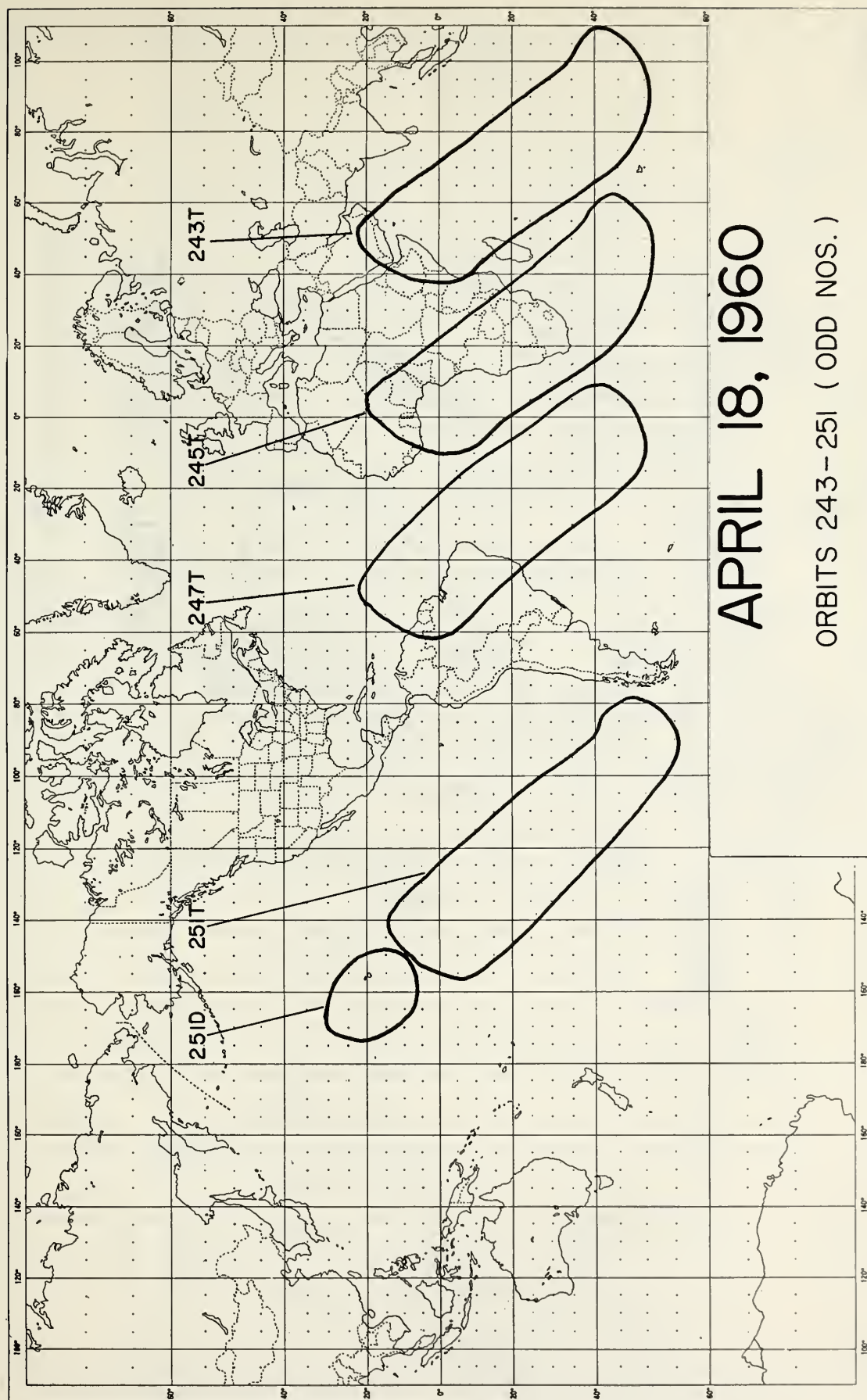


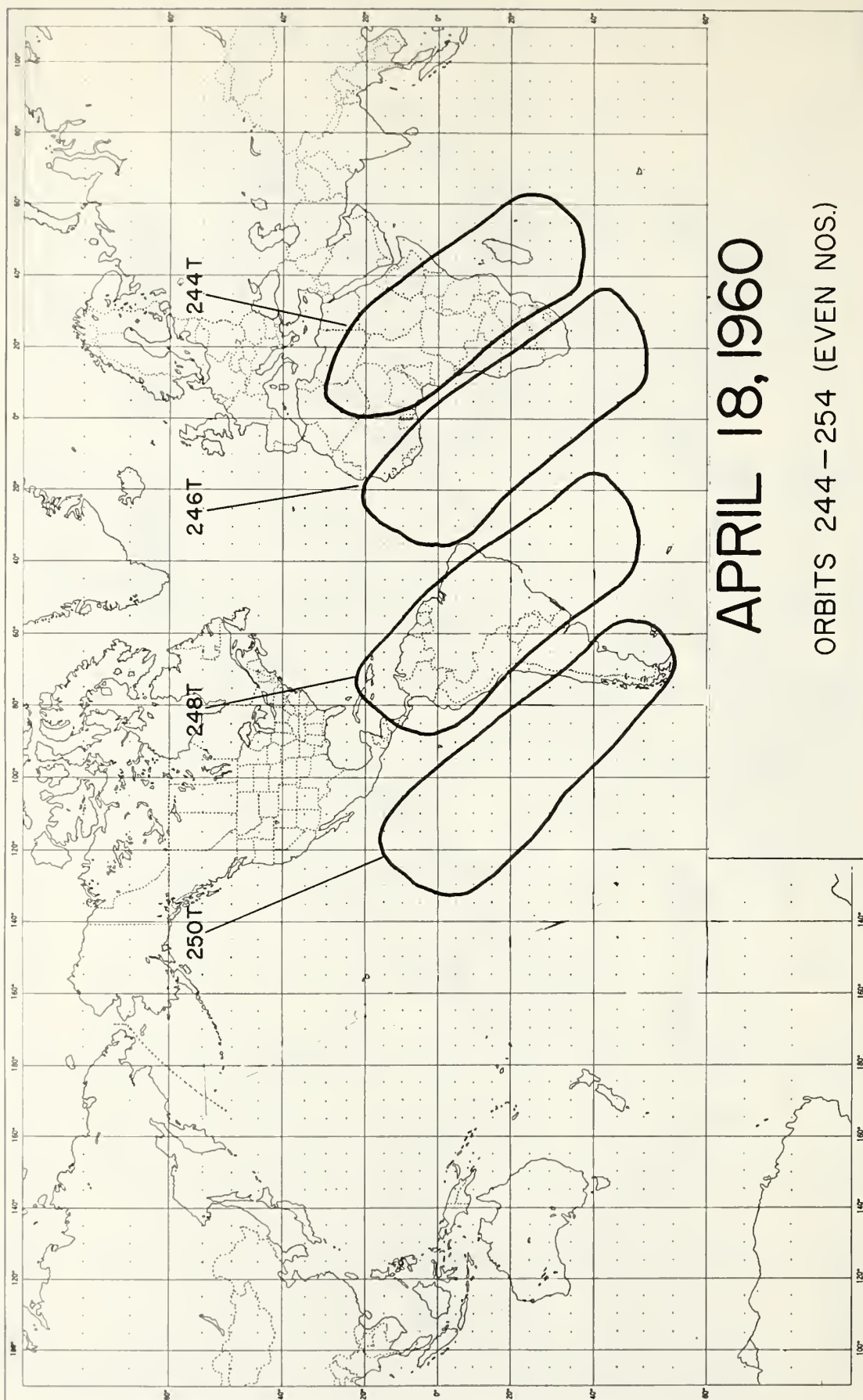


APRIL 16, 1960

ORBITS 214 - 220 (EVEN NOS.)

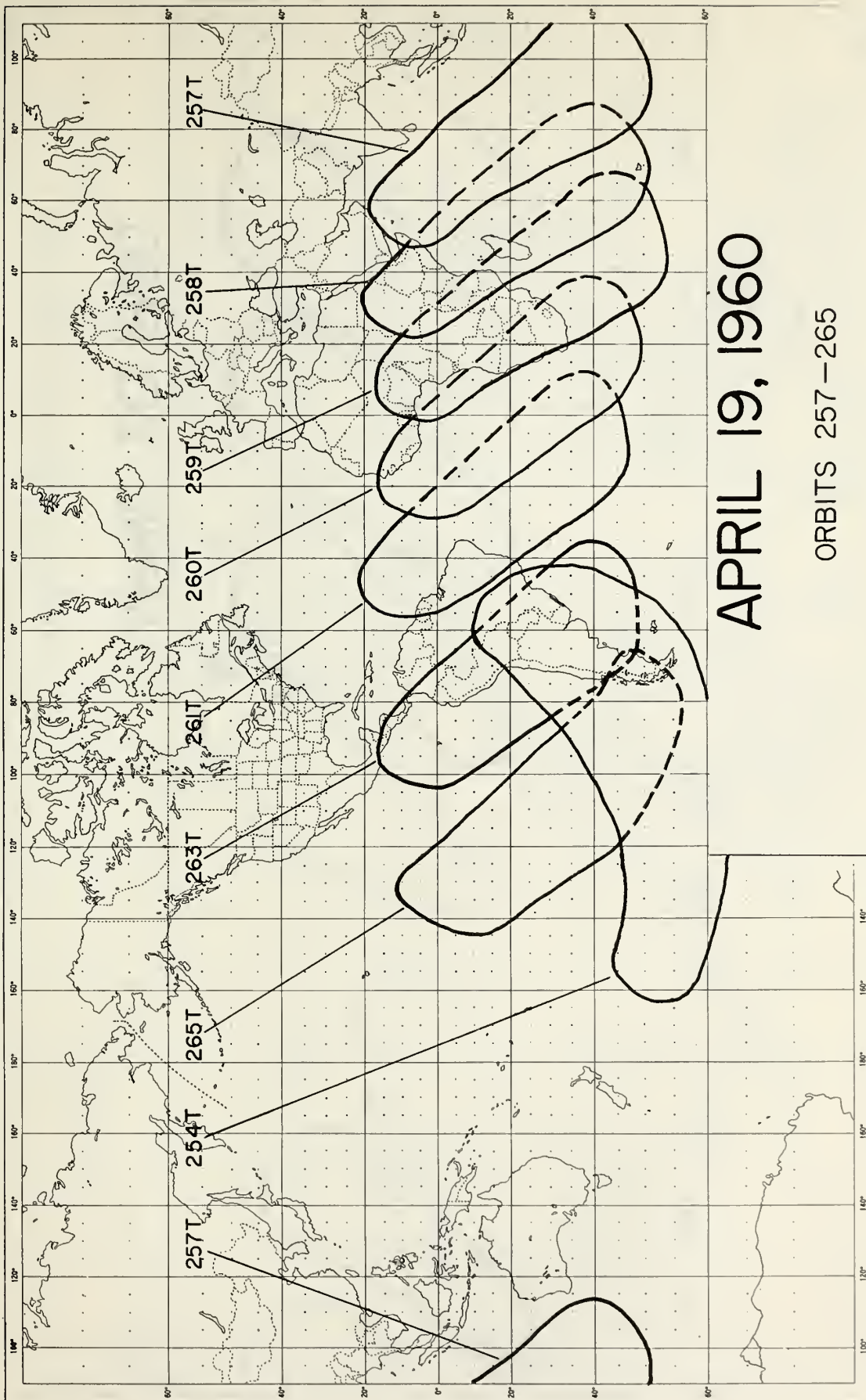




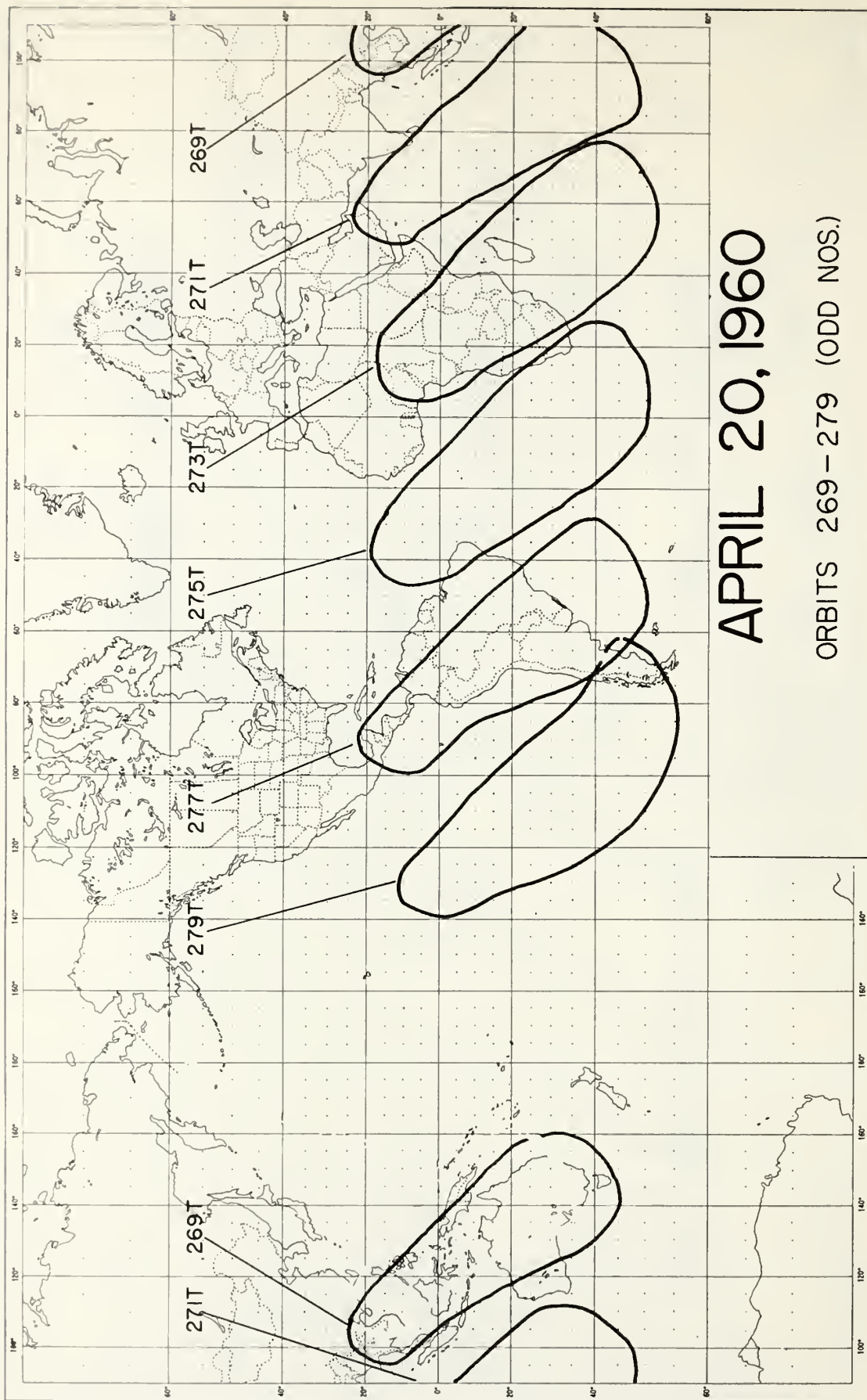


APRIL 18, 1960

ORBITS 244 - 254 (EVEN NOS.)

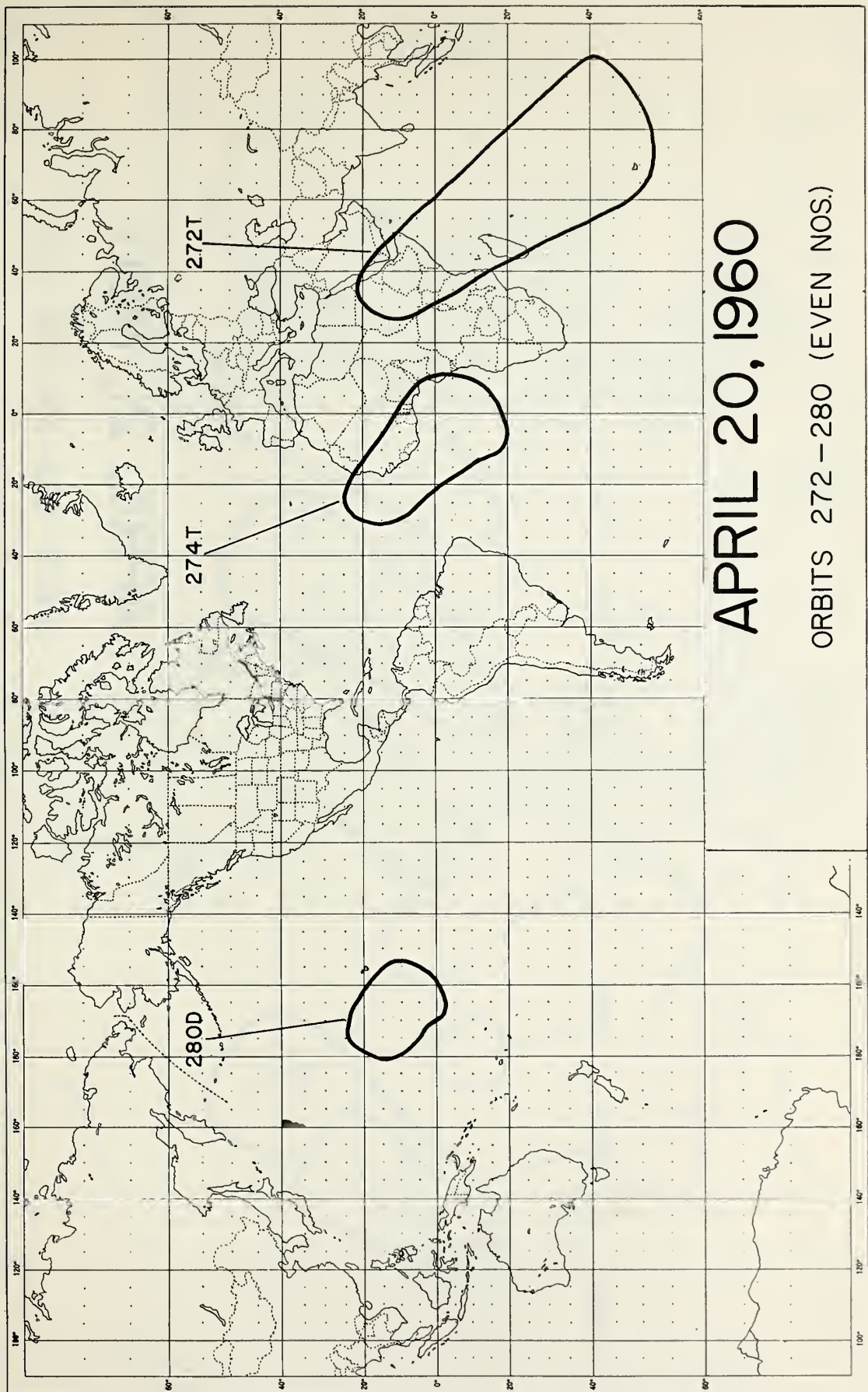


USC D-100-10-100

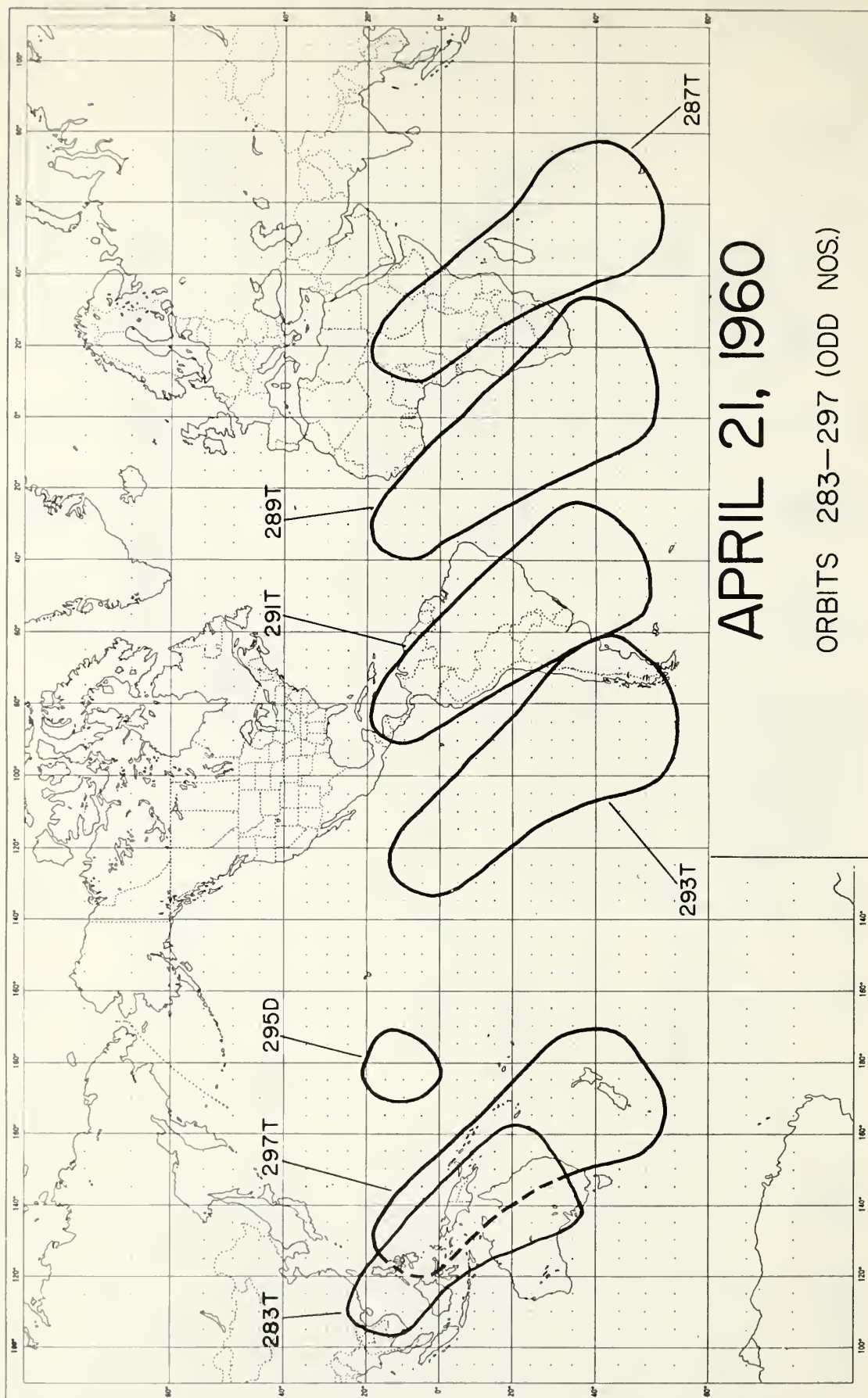


APRIL 20, 1960

ORBITS 269-279 (ODD NOS.)

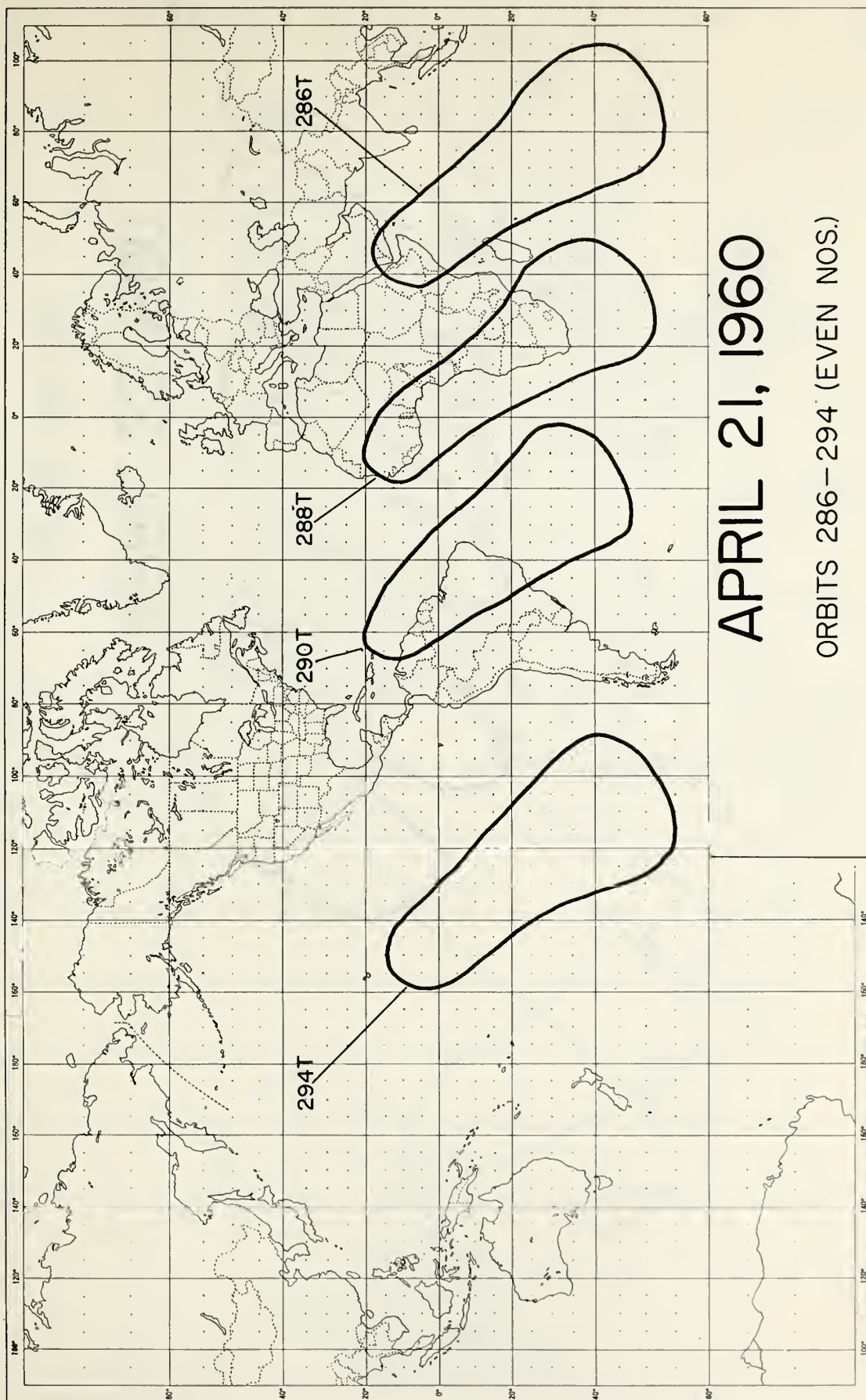


USCNAV-48-05



APRIL 21, 1960

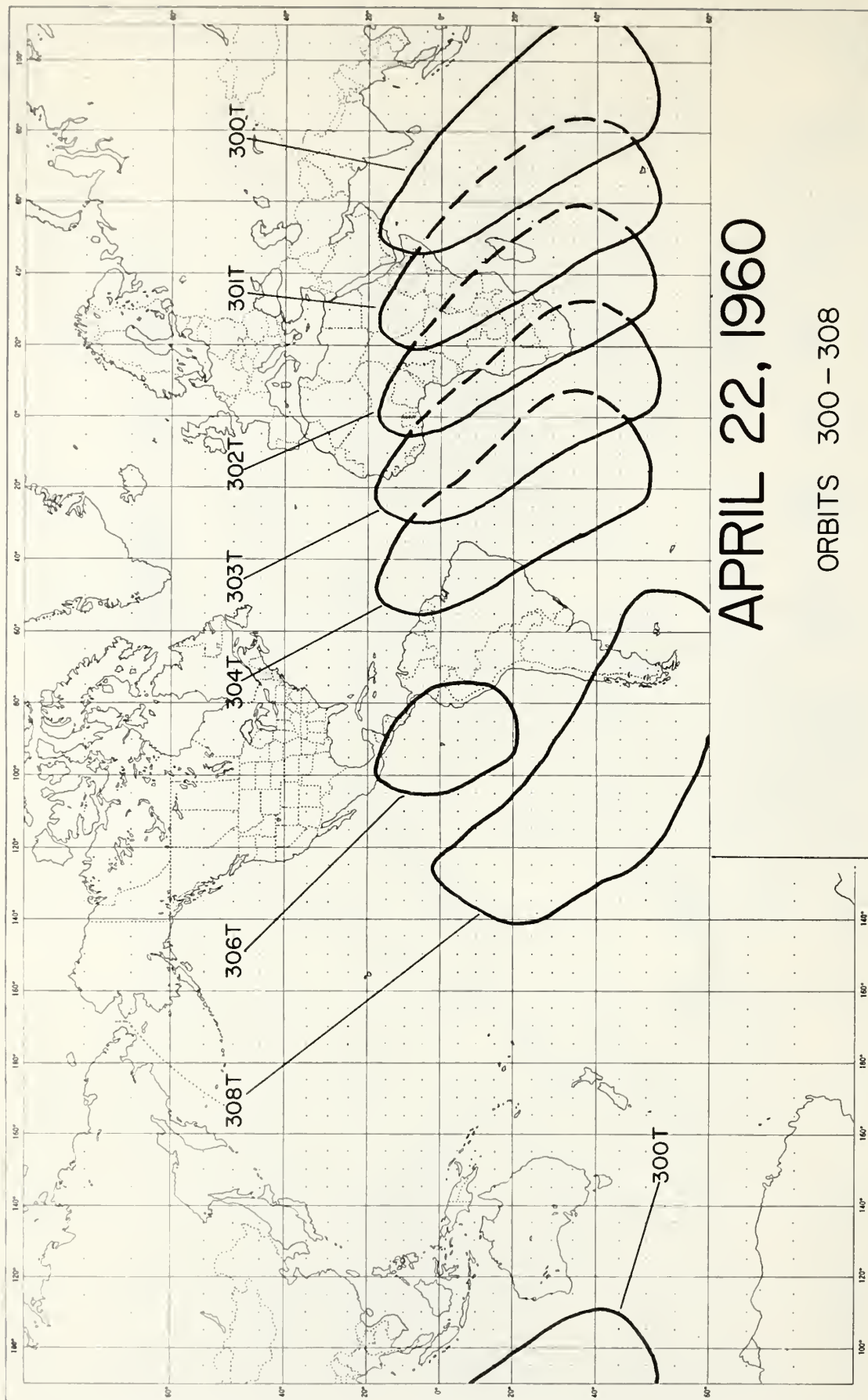
ORBITS 283-297 (ODD NOS.)



APRIL 21, 1960

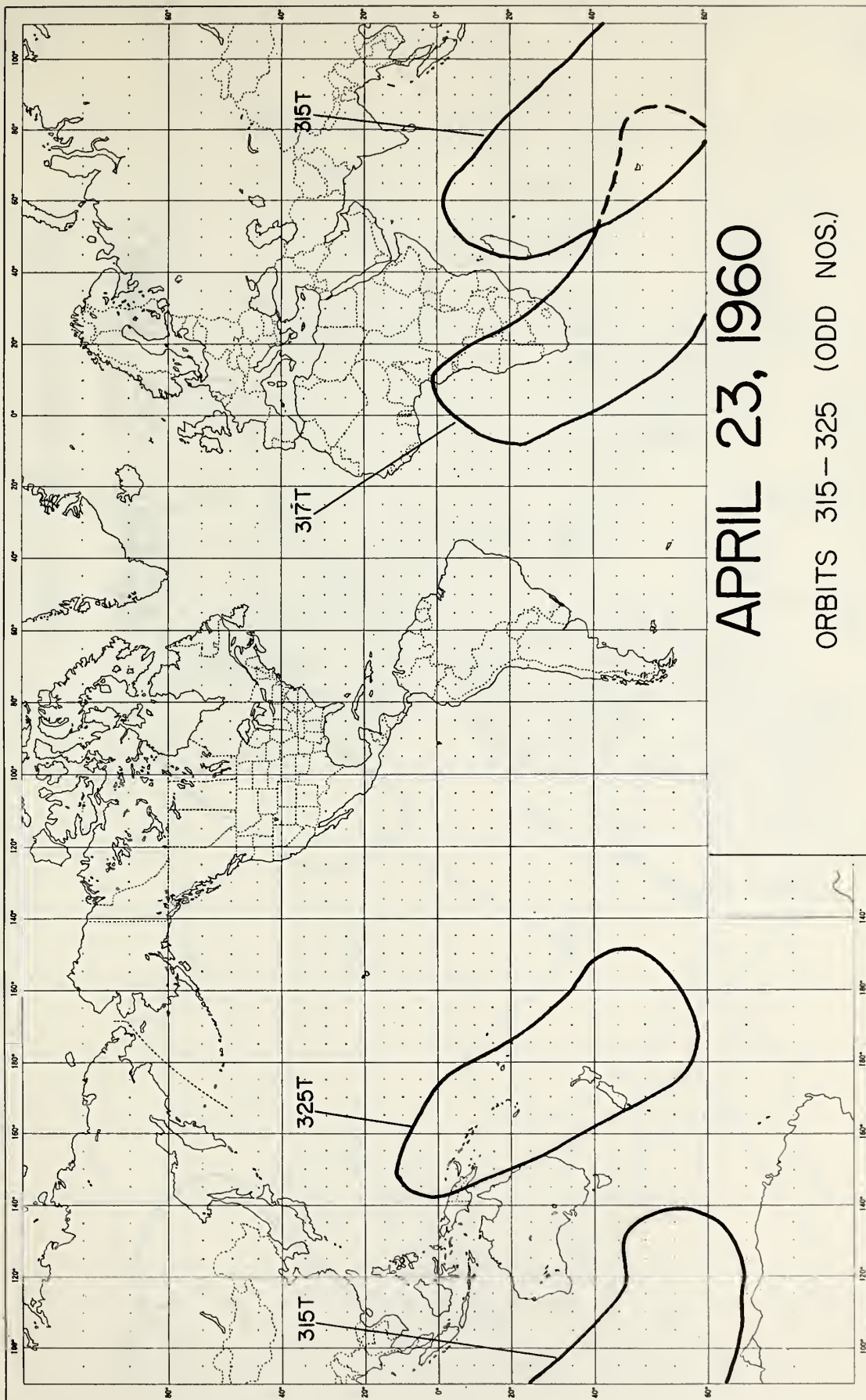
ORBITS 286-294 (EVEN NOS.)

USCDA-49-100



APRIL 22, 1960

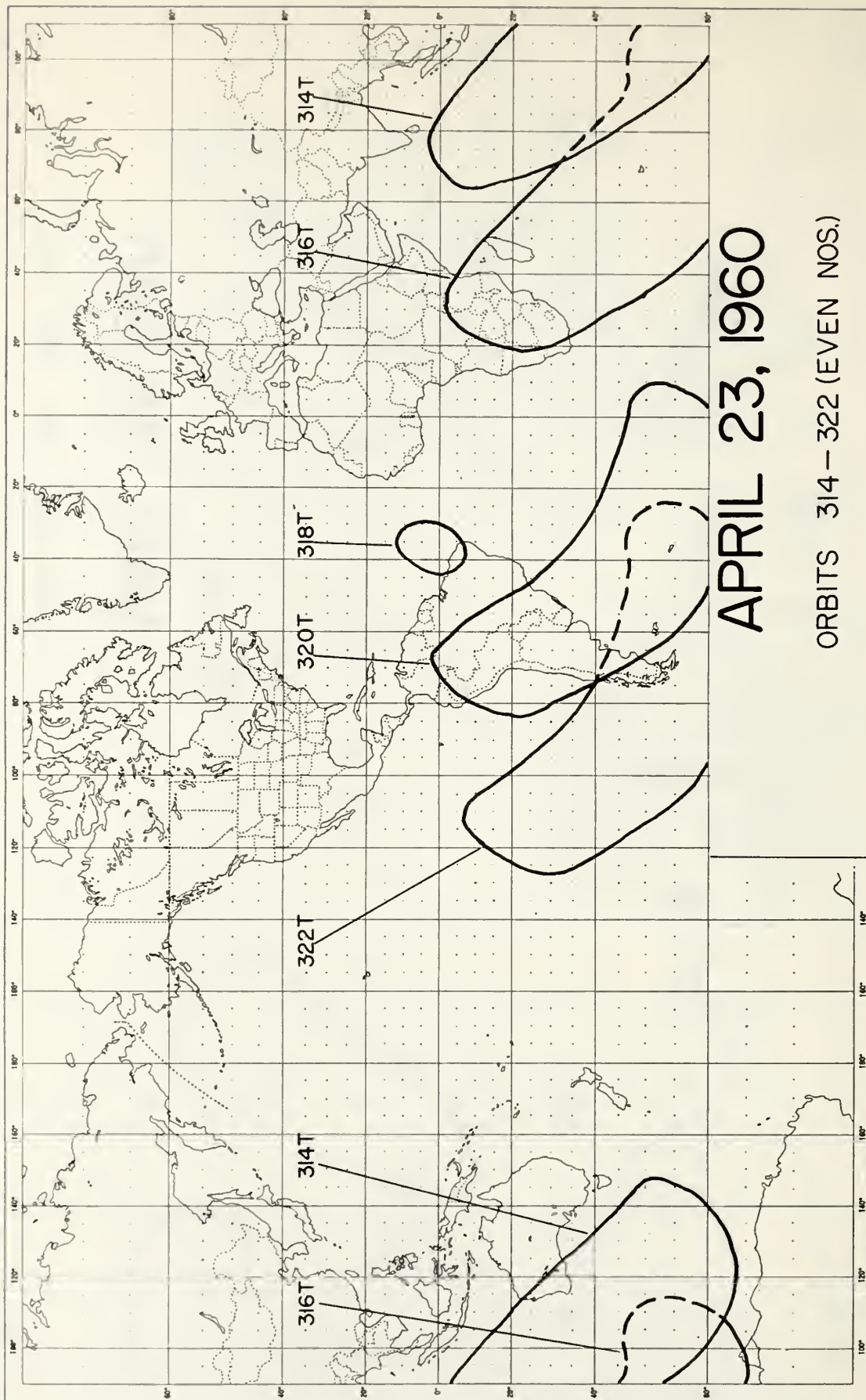
ORBITS 300 - 308

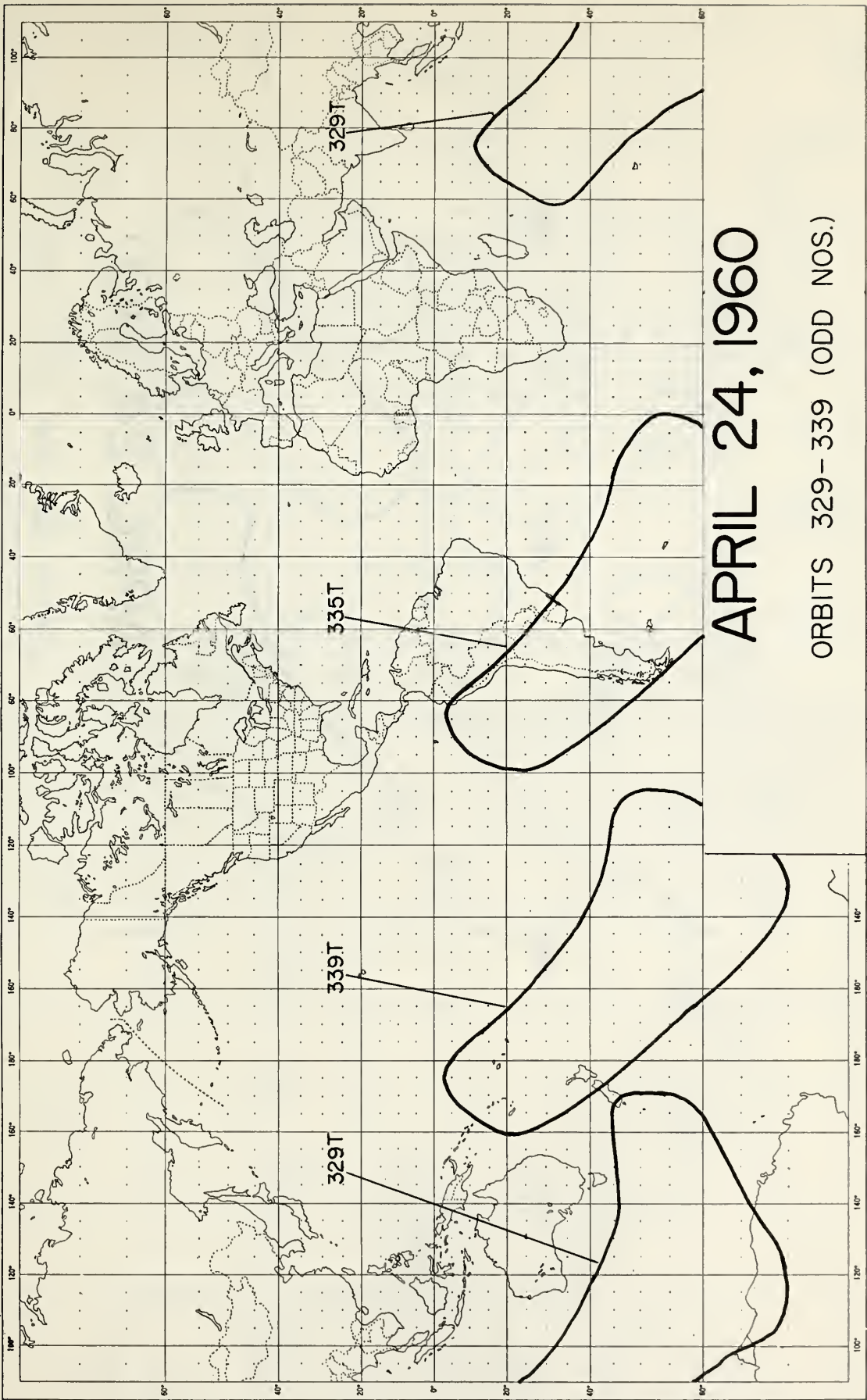


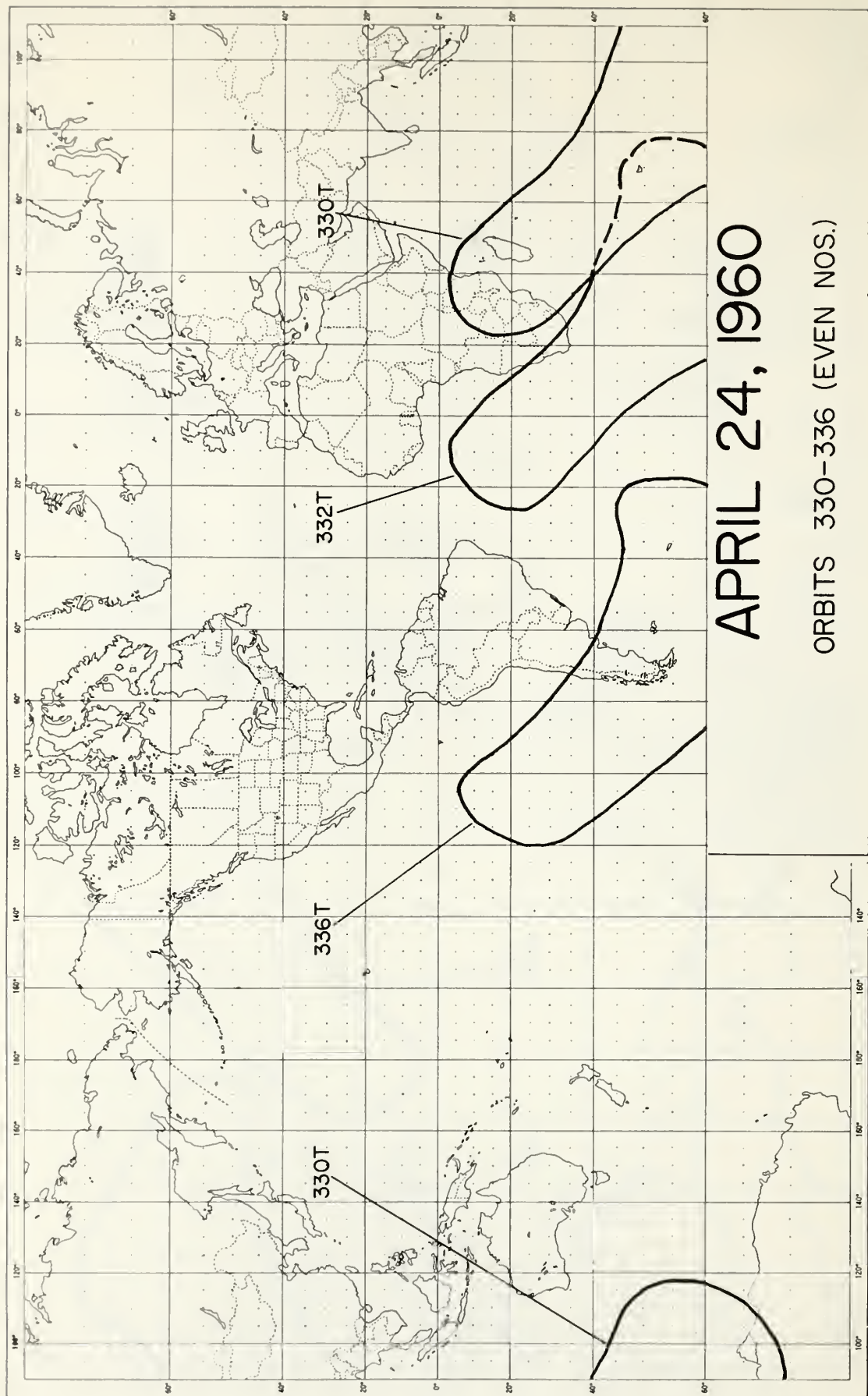
APRIL 23, 1960

ORBITS 315-325 (ODD NOS.)

USCIB-48-2C

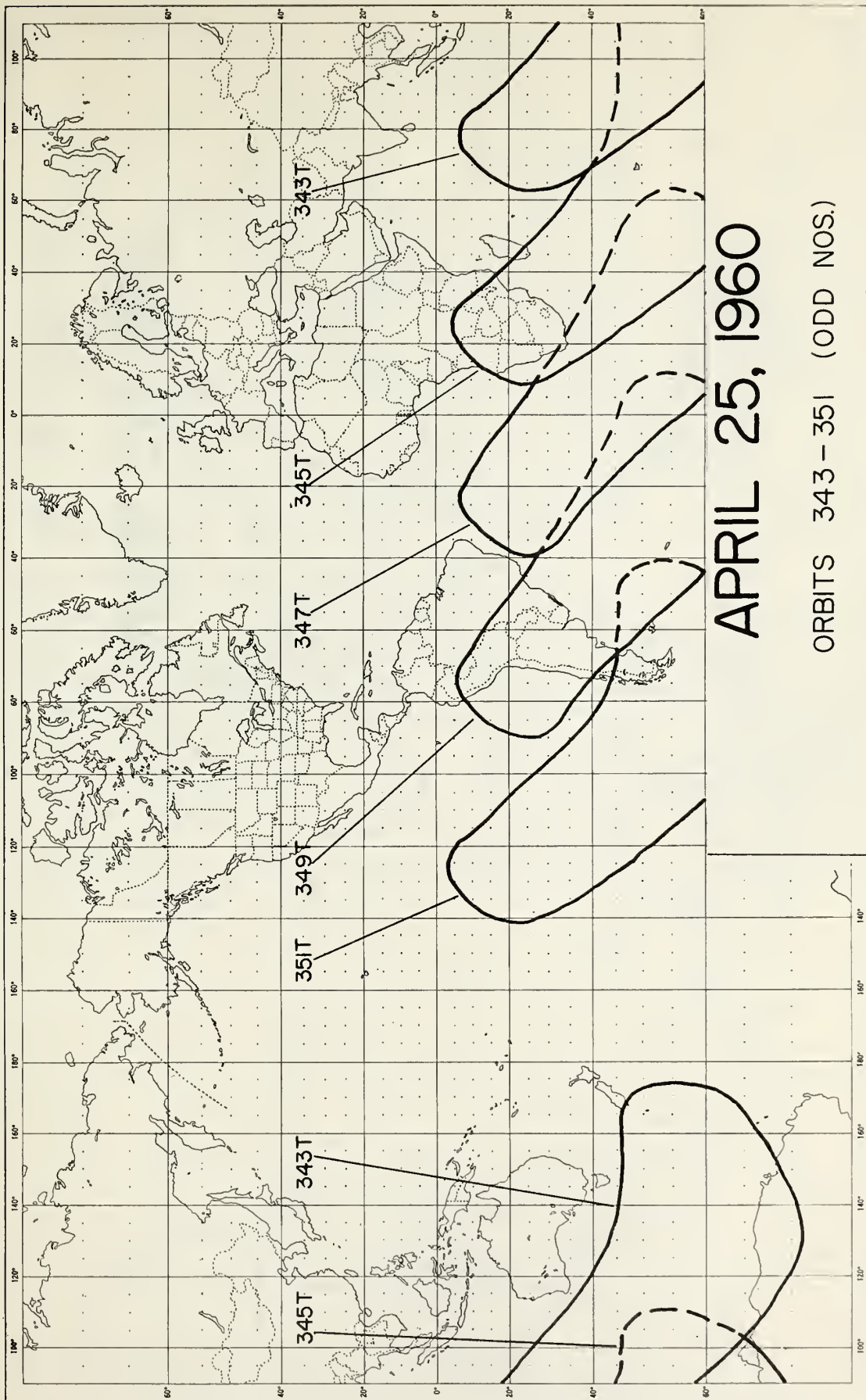






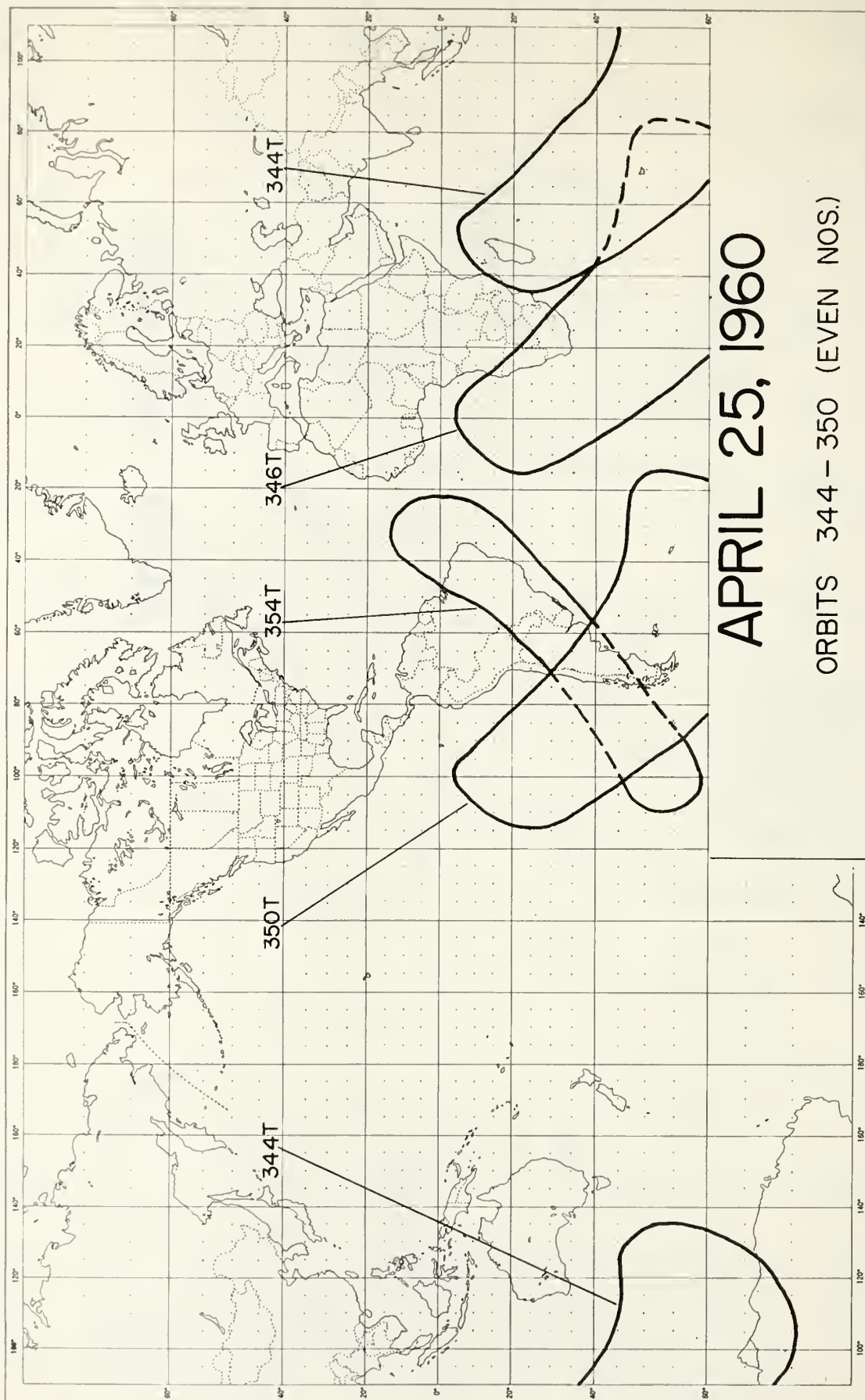
APRIL 24, 1960

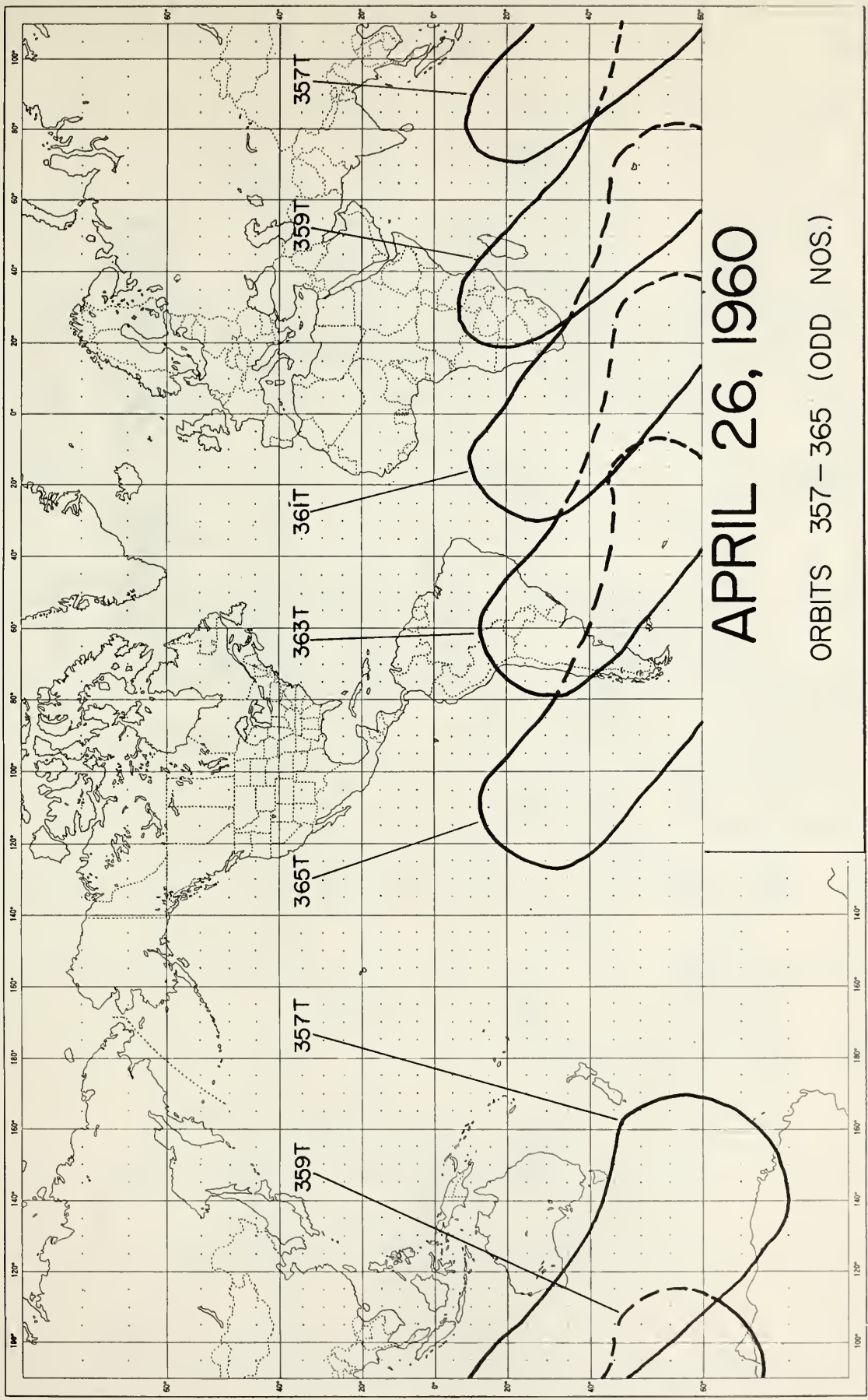
ORBITS 330-336 (EVEN NOS.)



APRIL 25, 1960

ORBITS 343 - 351 (ODD NOS.)

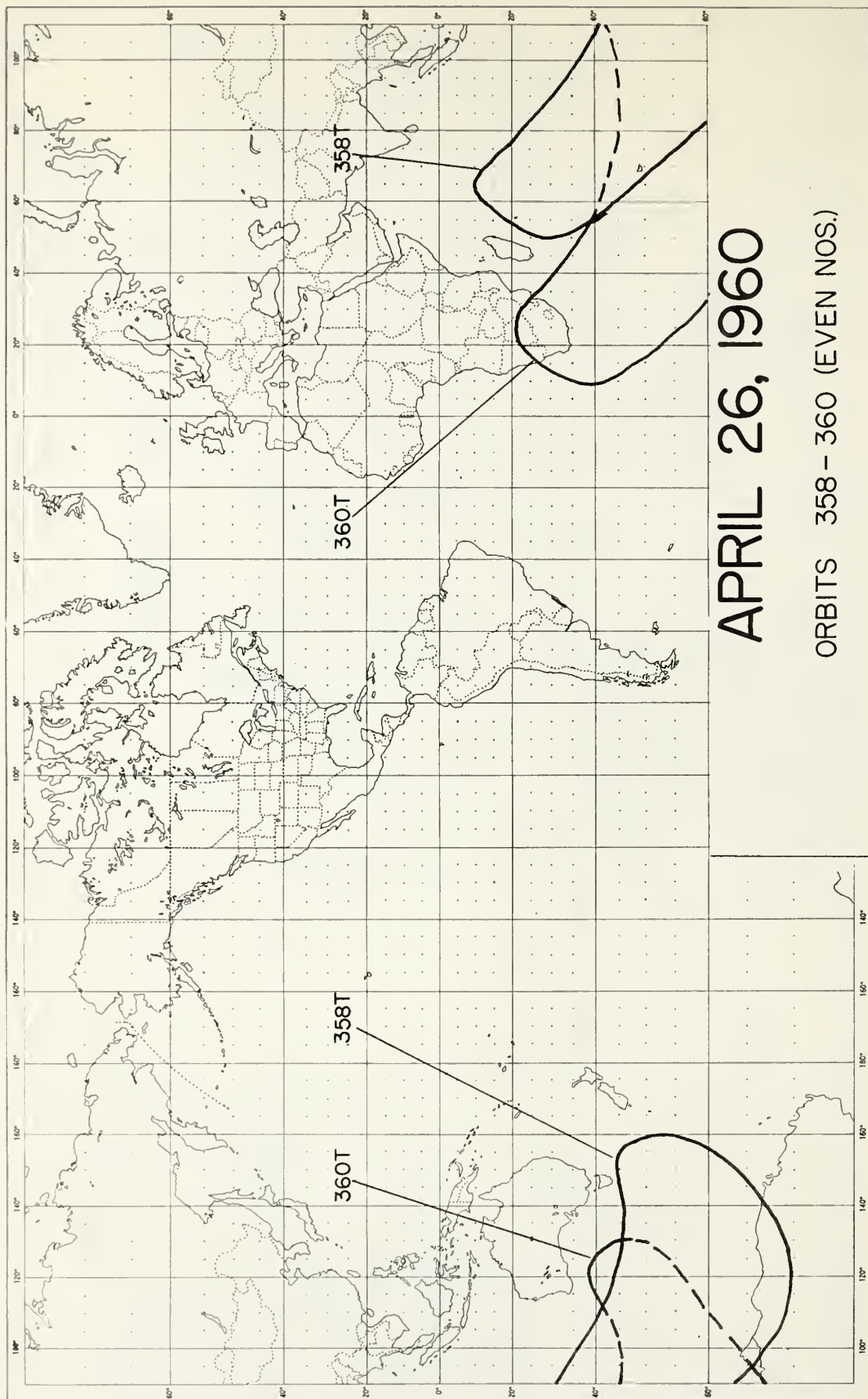


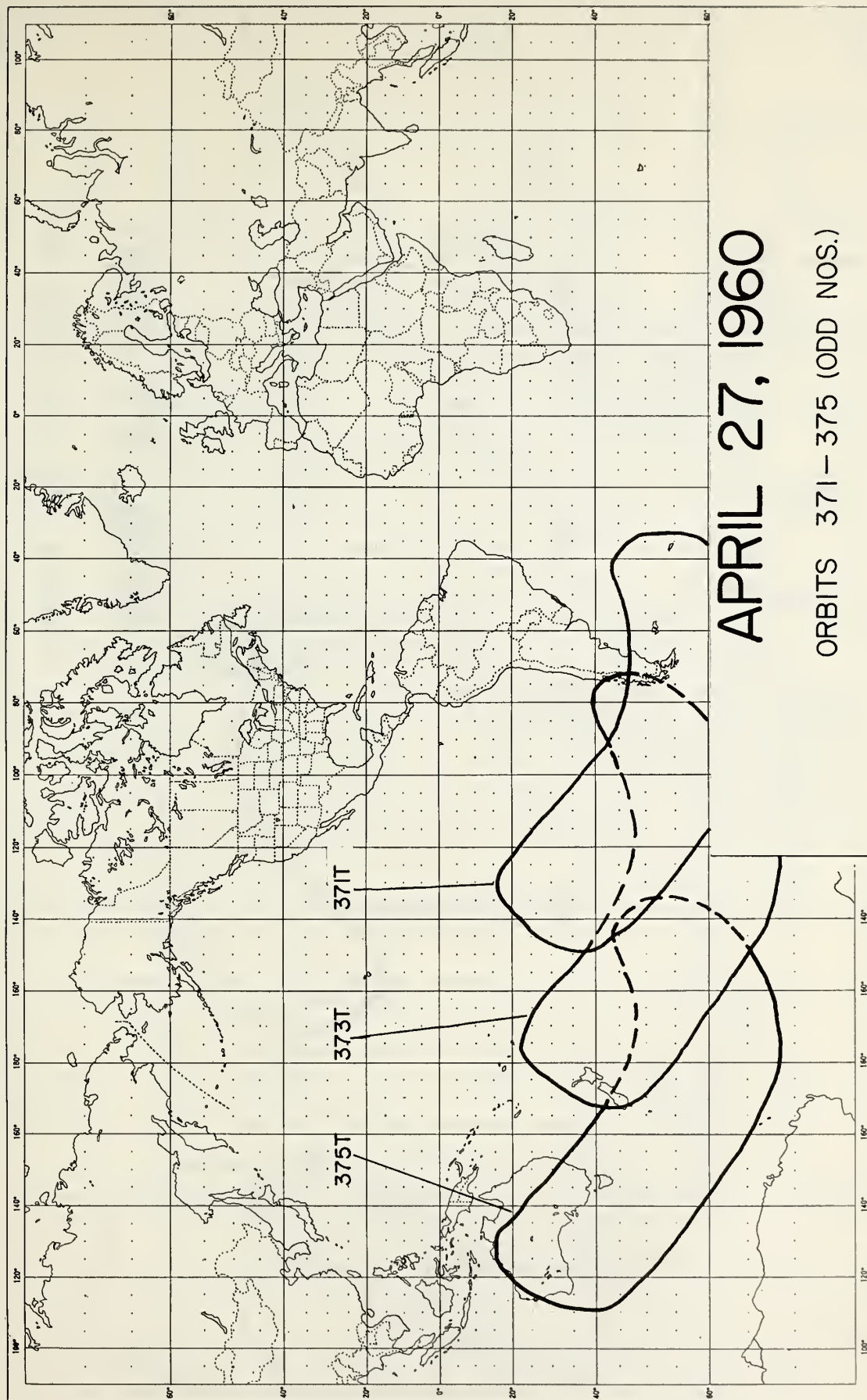


APRIL 26, 1960

ORBITS 357-365 (ODD NOS.)

USCIB-40-20

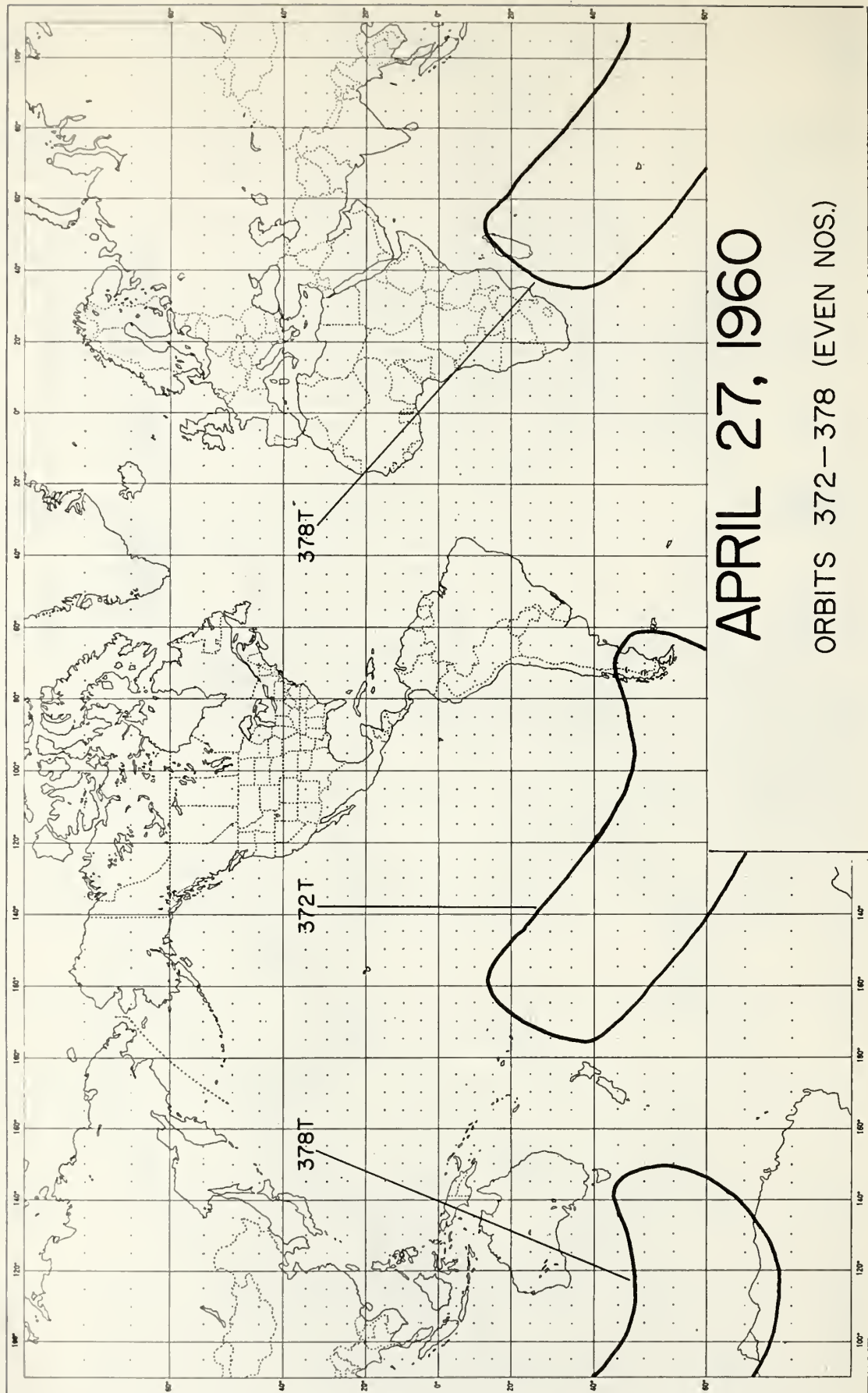


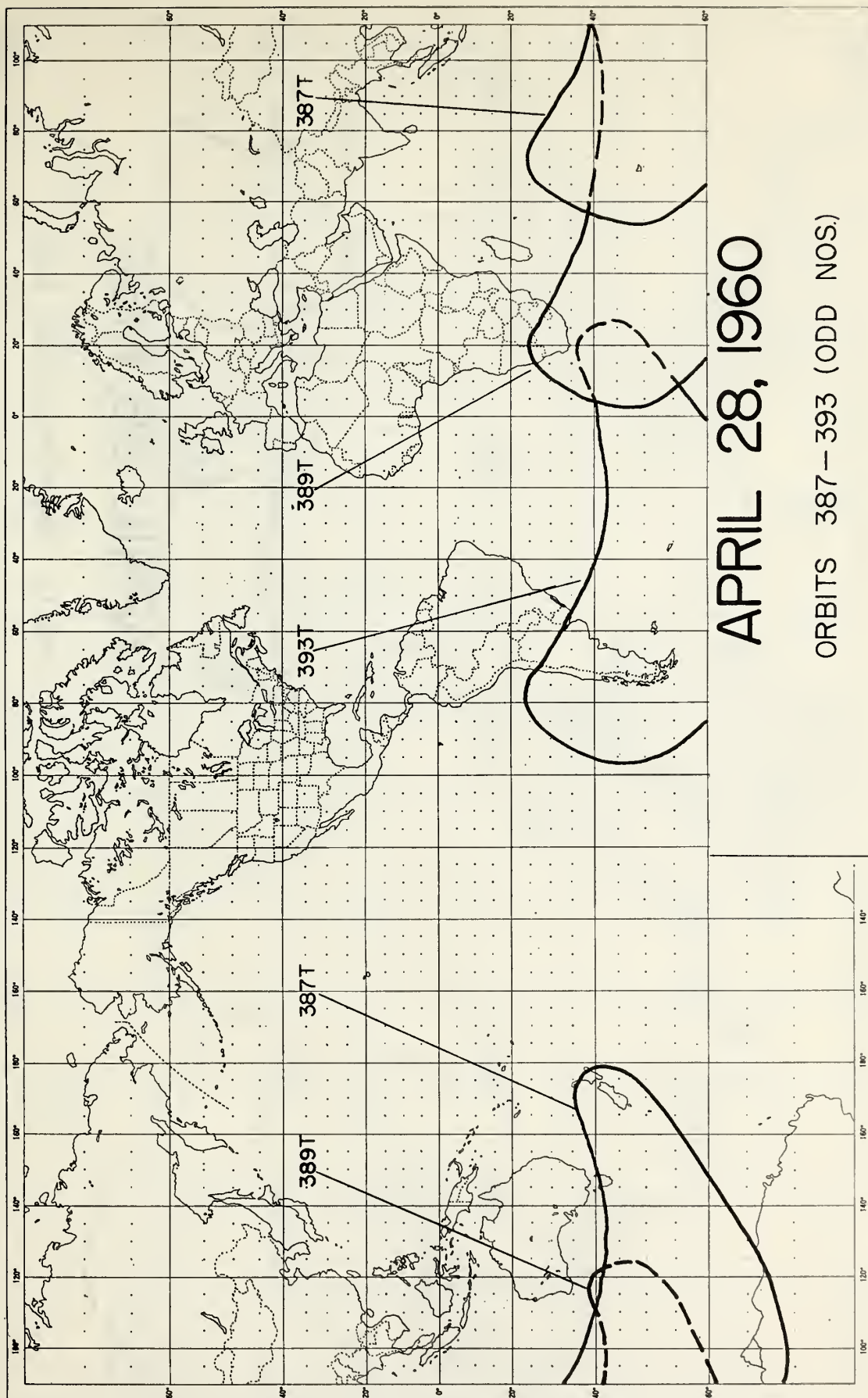


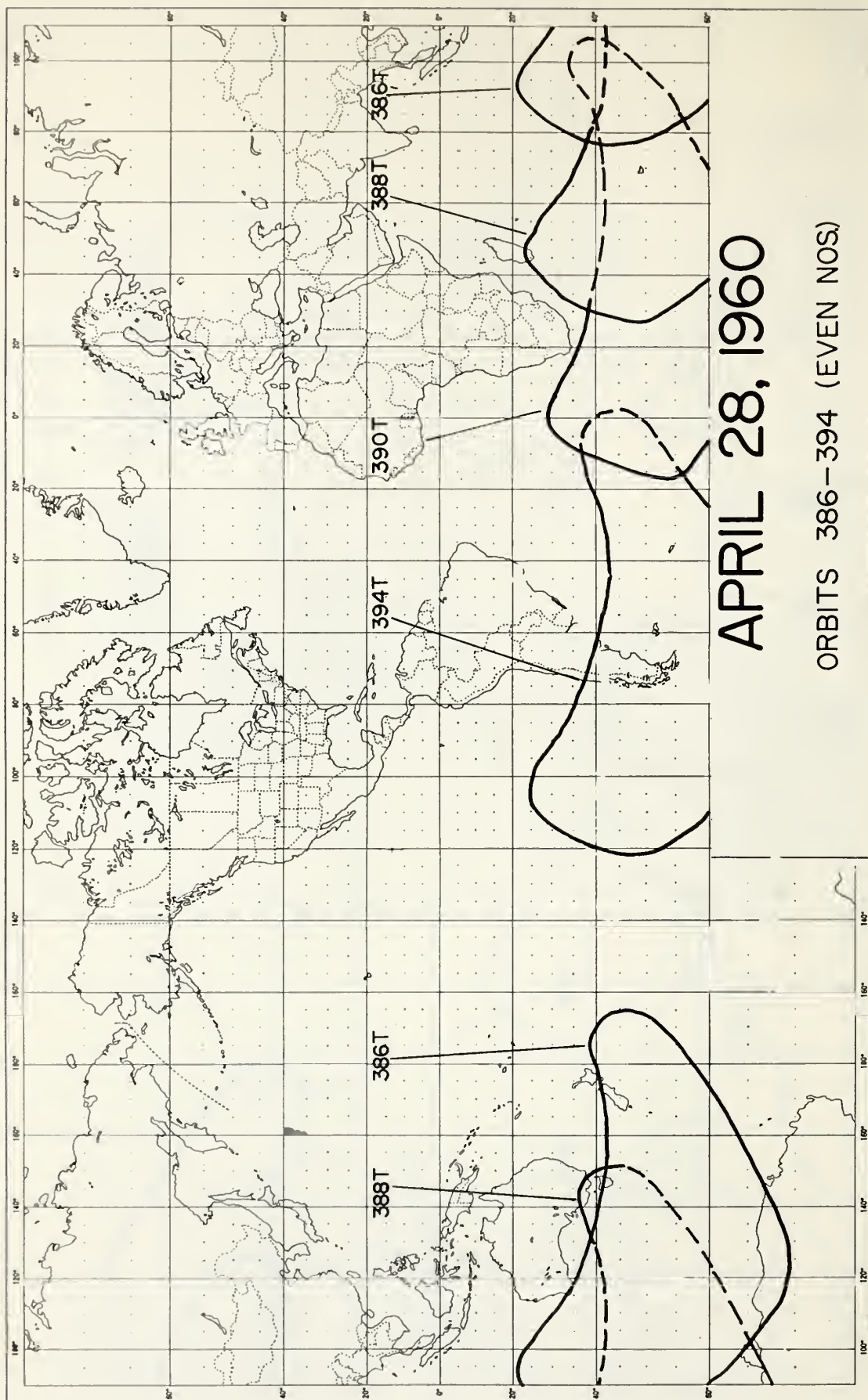
APRIL 27, 1960

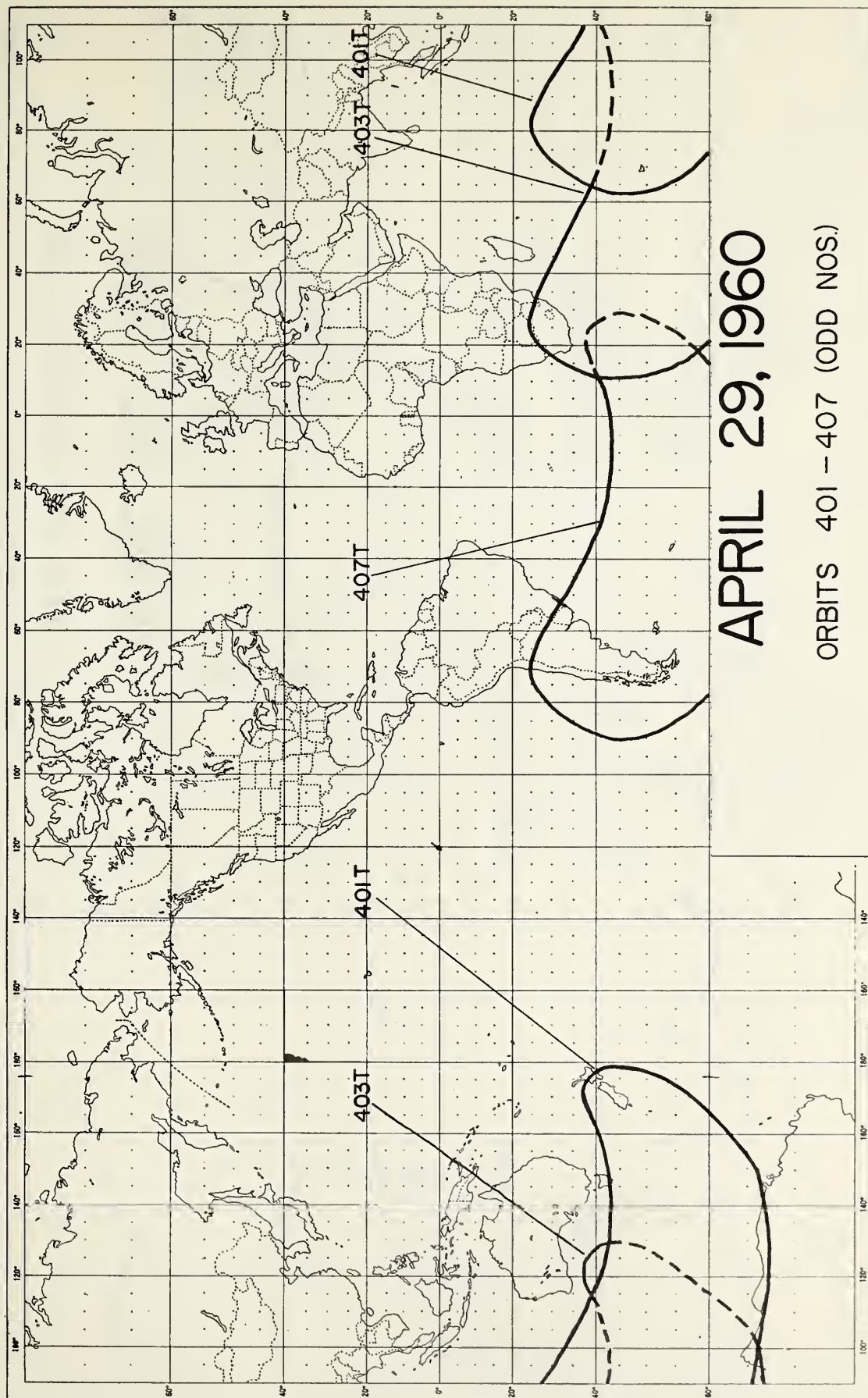
ORBITS 371-375 (ODD NOS.)

U.S. NAVY-40-20



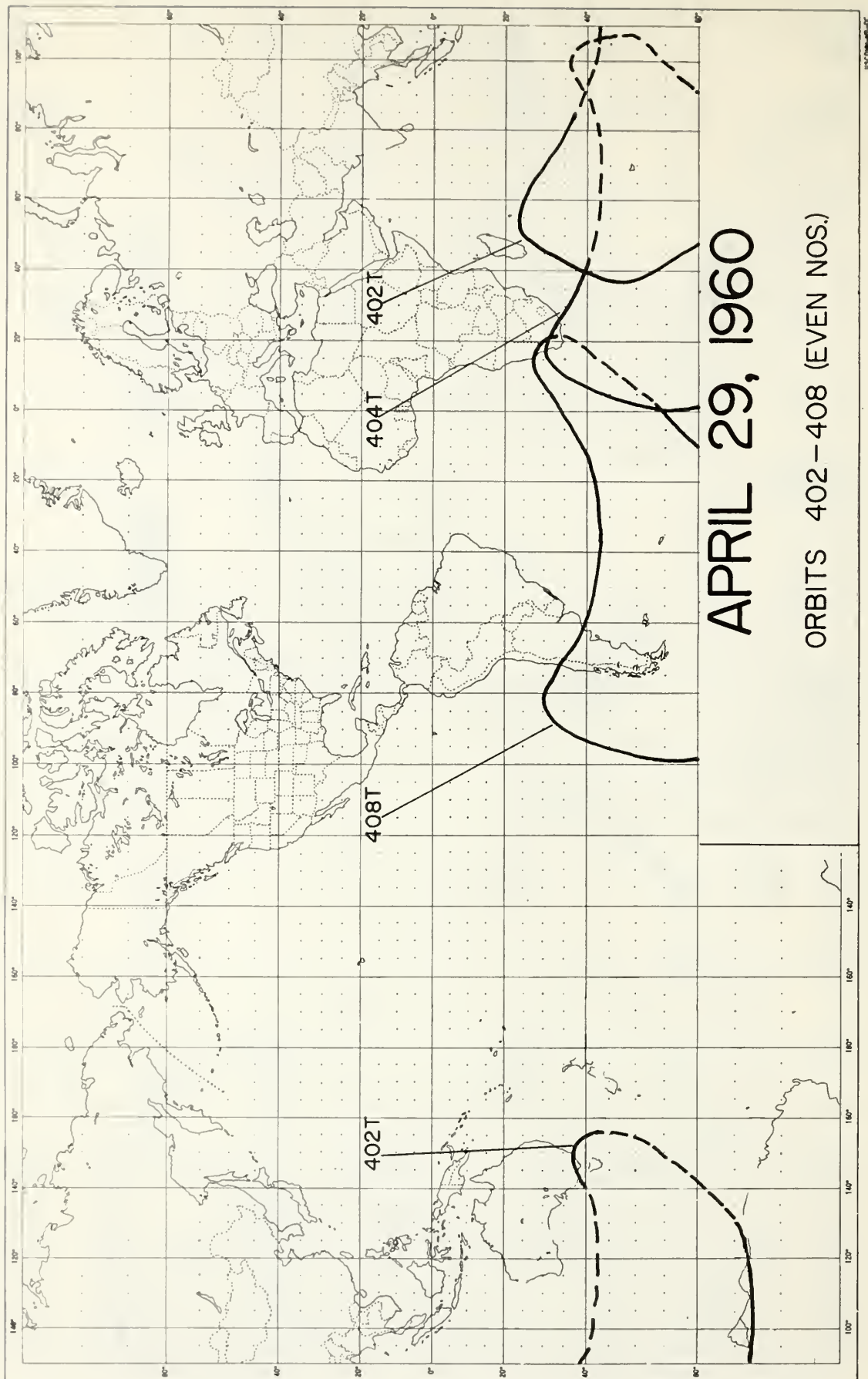


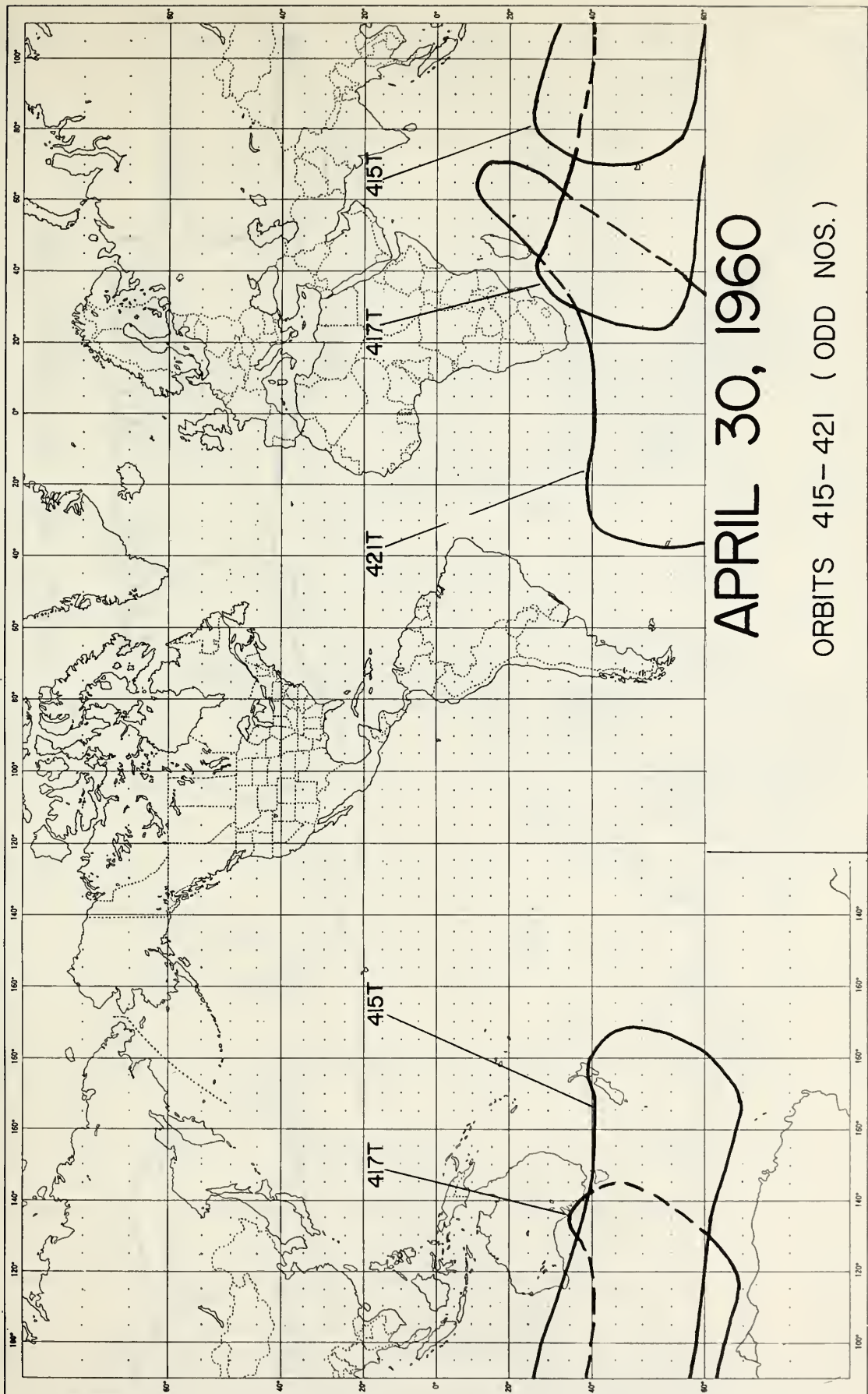




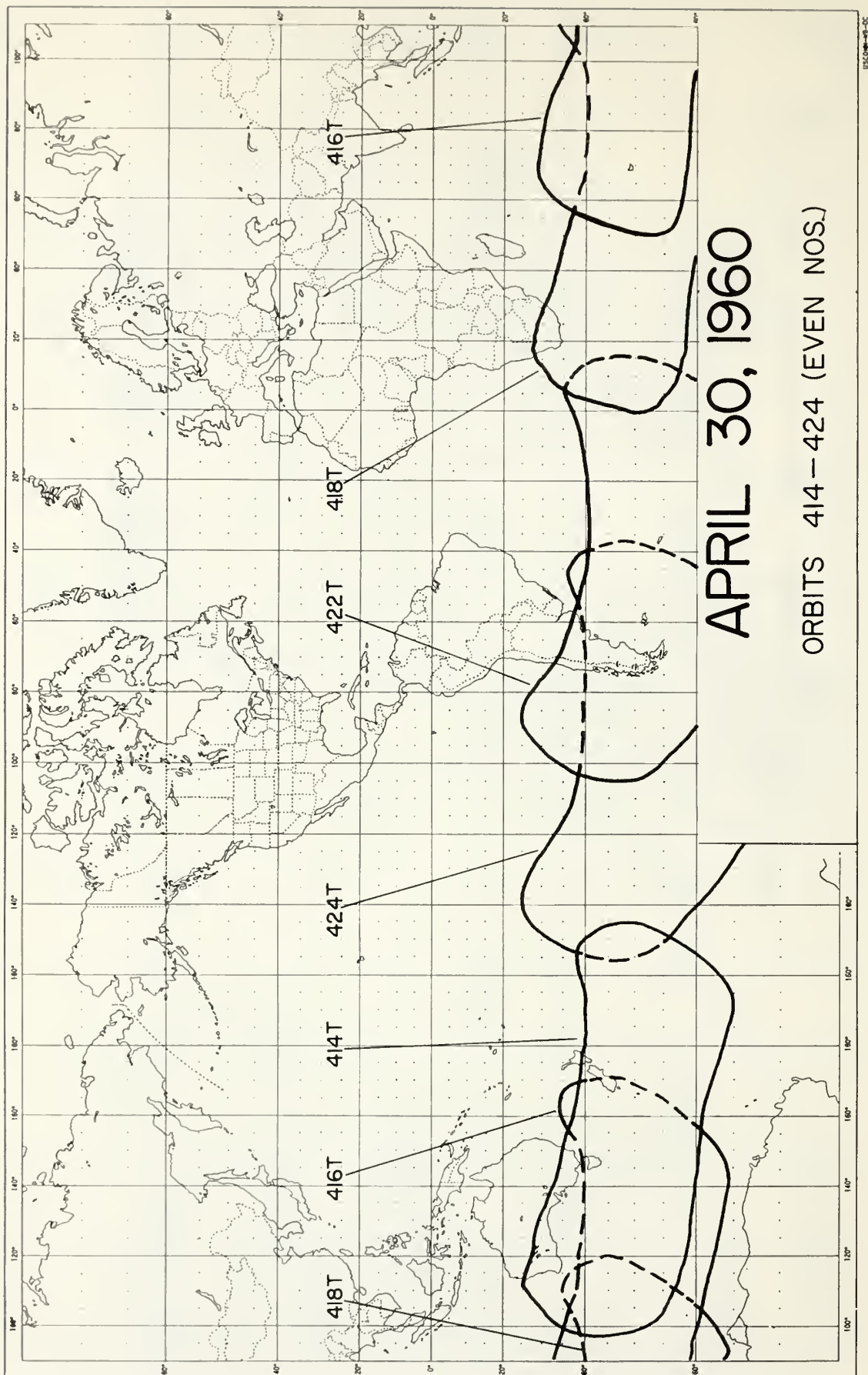
APRIL 29, 1960

ORBITS 401 - 407 (ODD NOS)



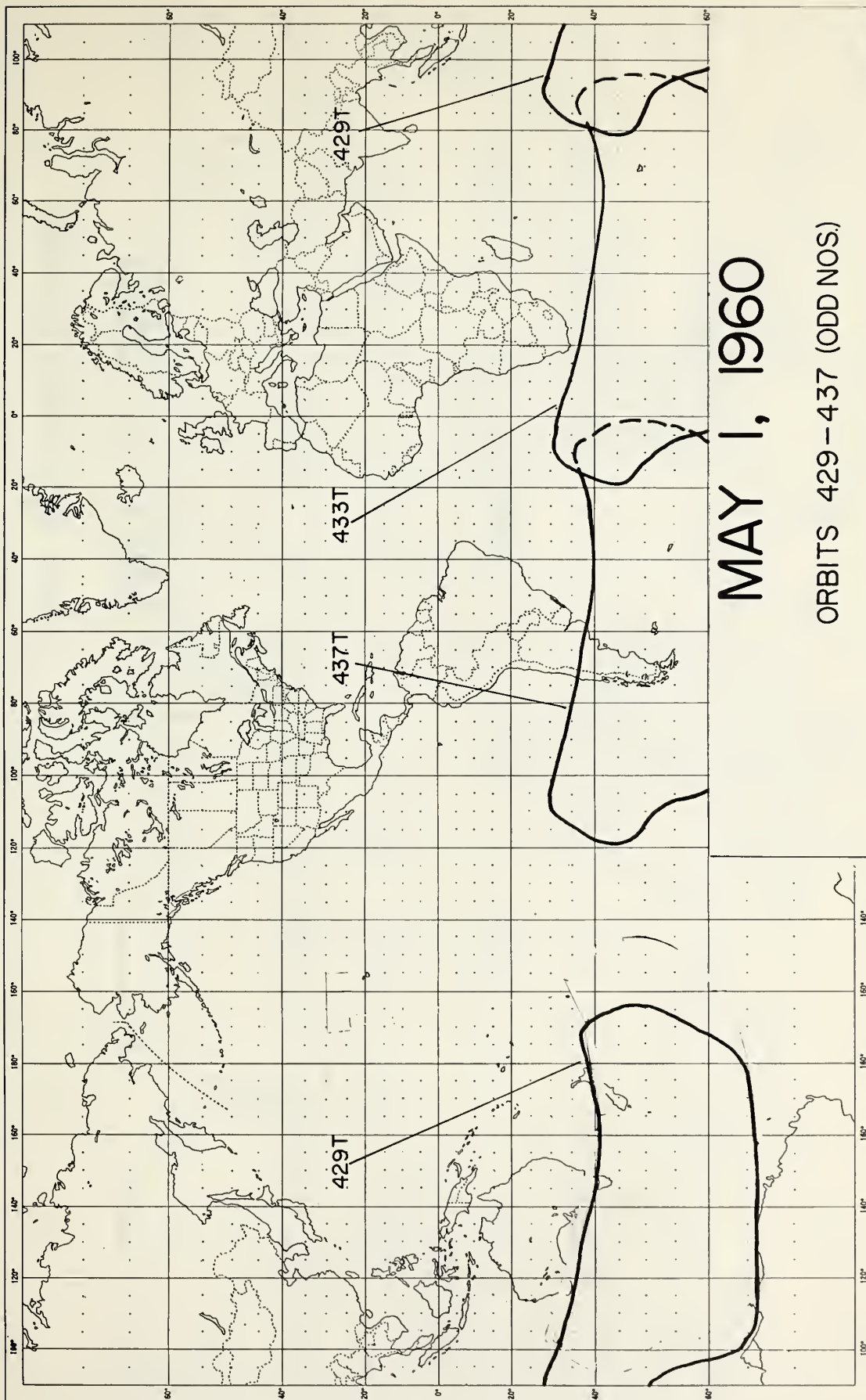


USCNAV-49-2C



APRIL 30, 1960

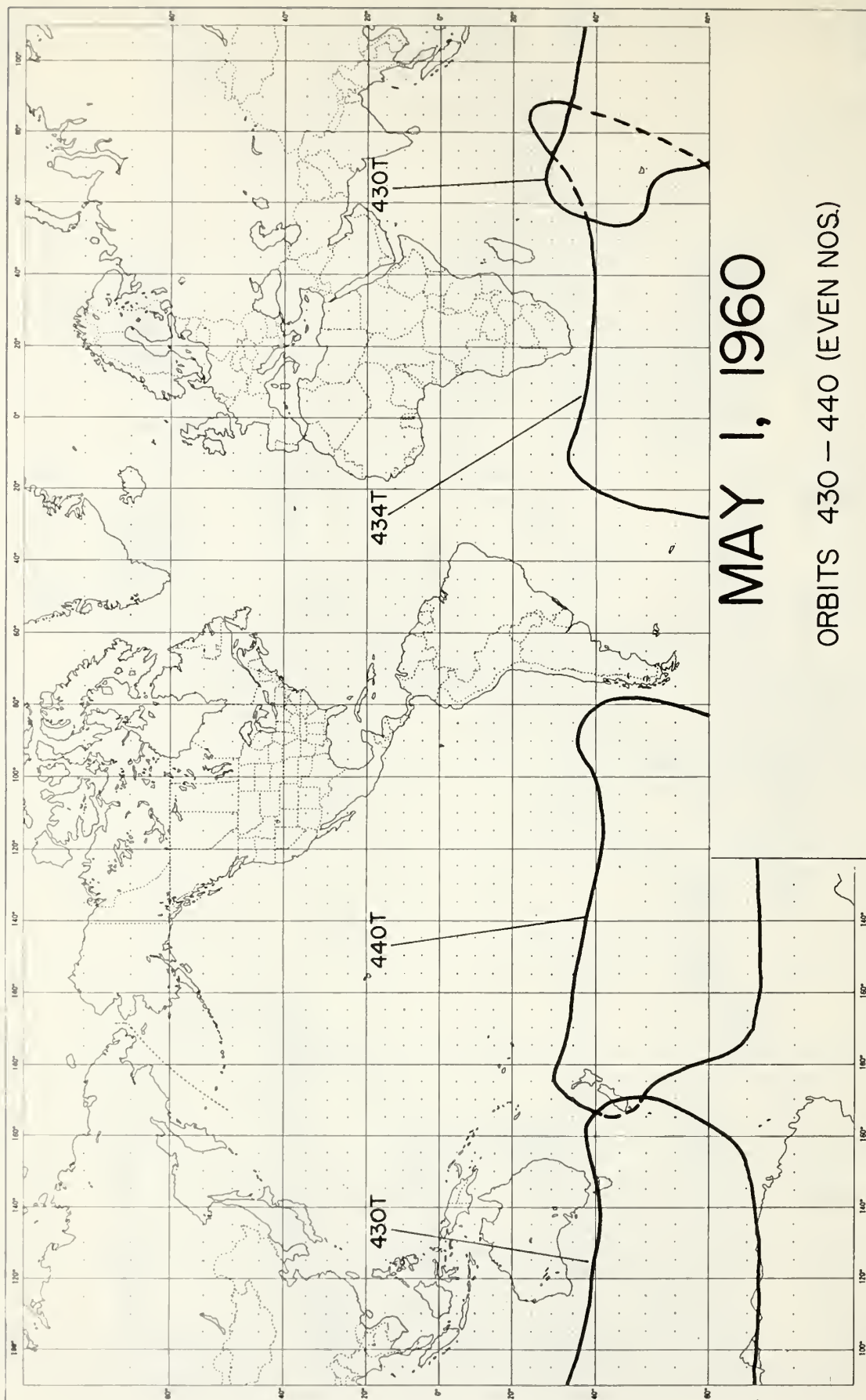
ORBITS 414-424 (EVEN NOS.)

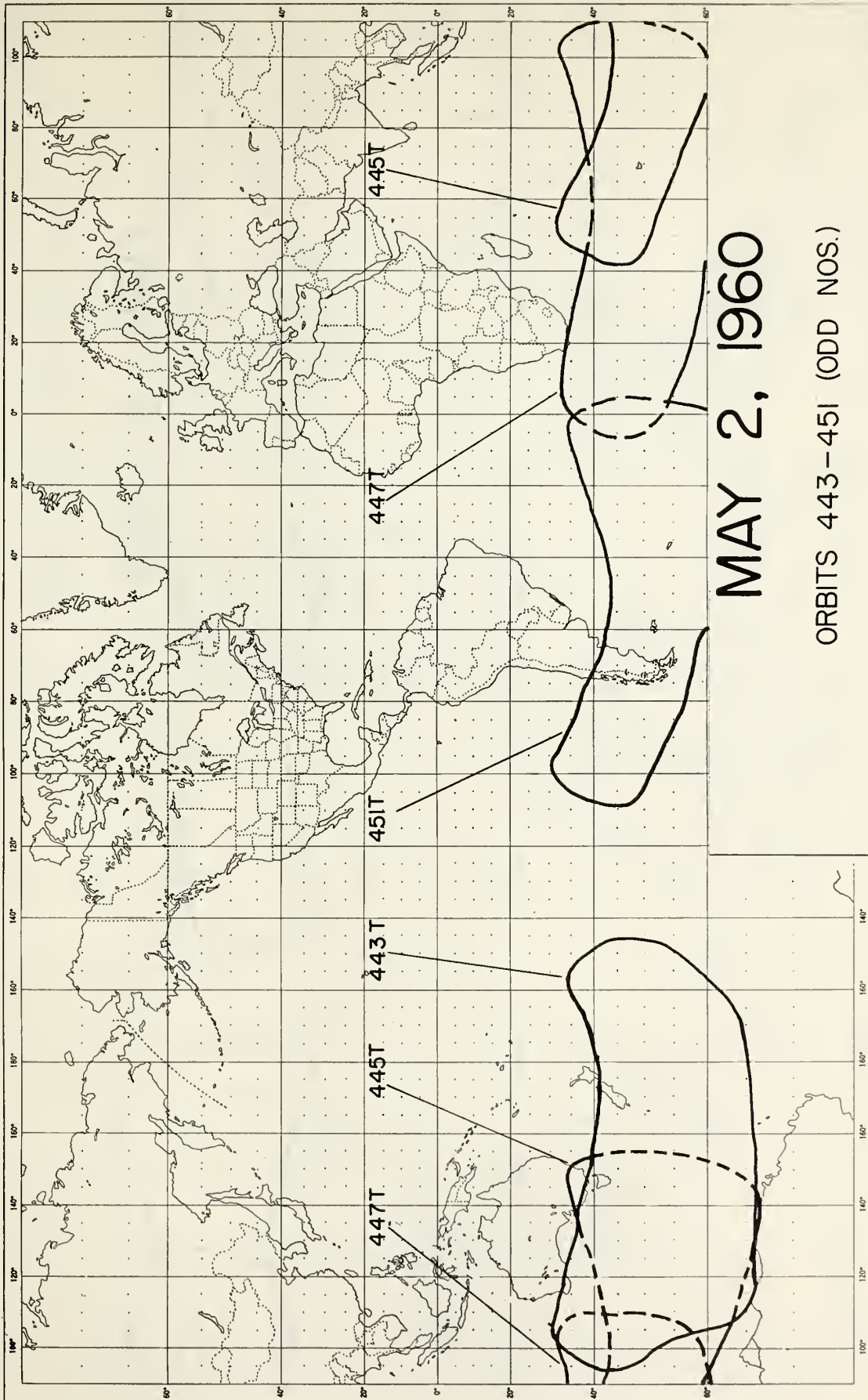


MAY 1, 1960

ORBITS 429-437 (ODD NOS.)

USCNAV-9-2C

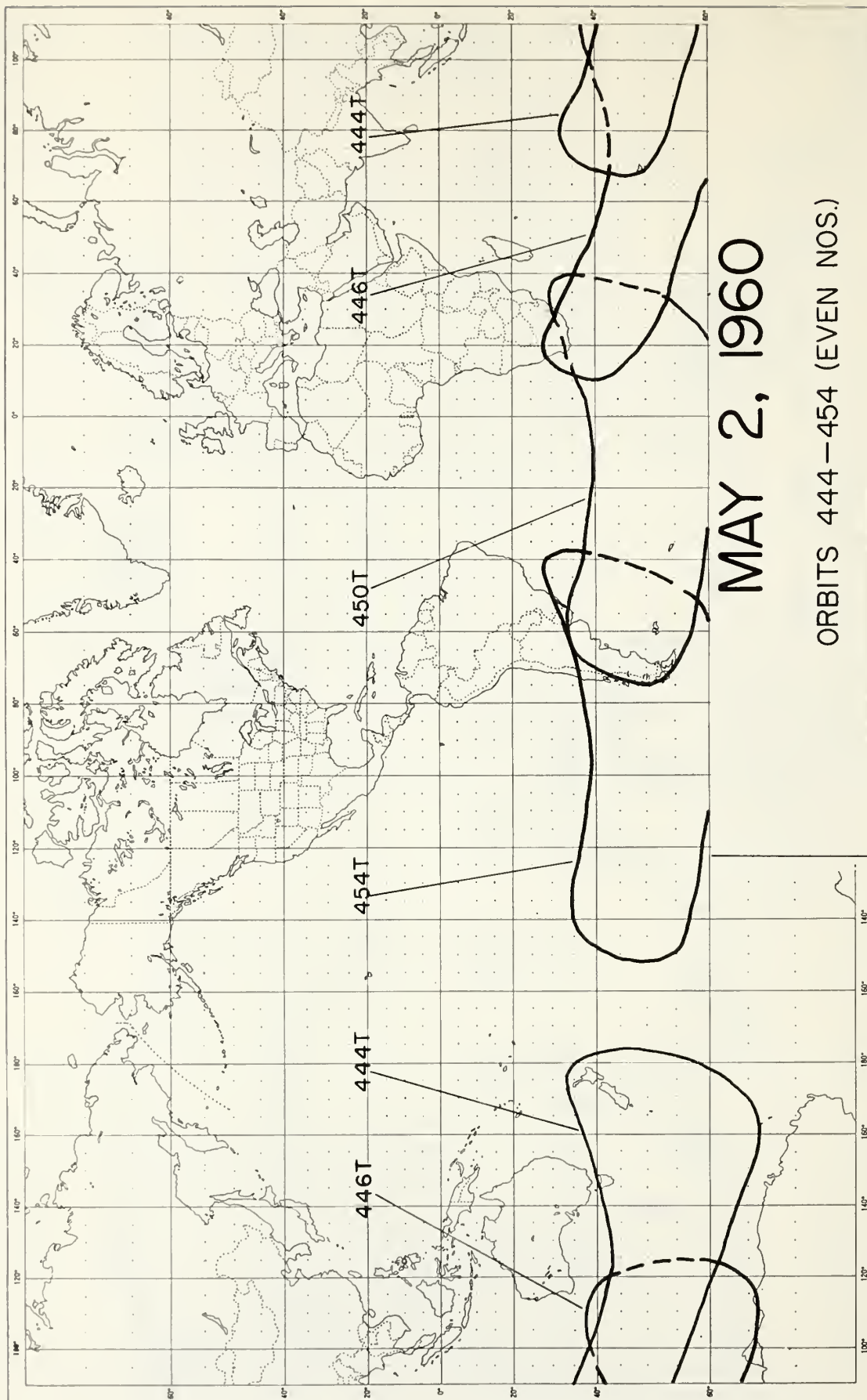




MAY 2, 1960

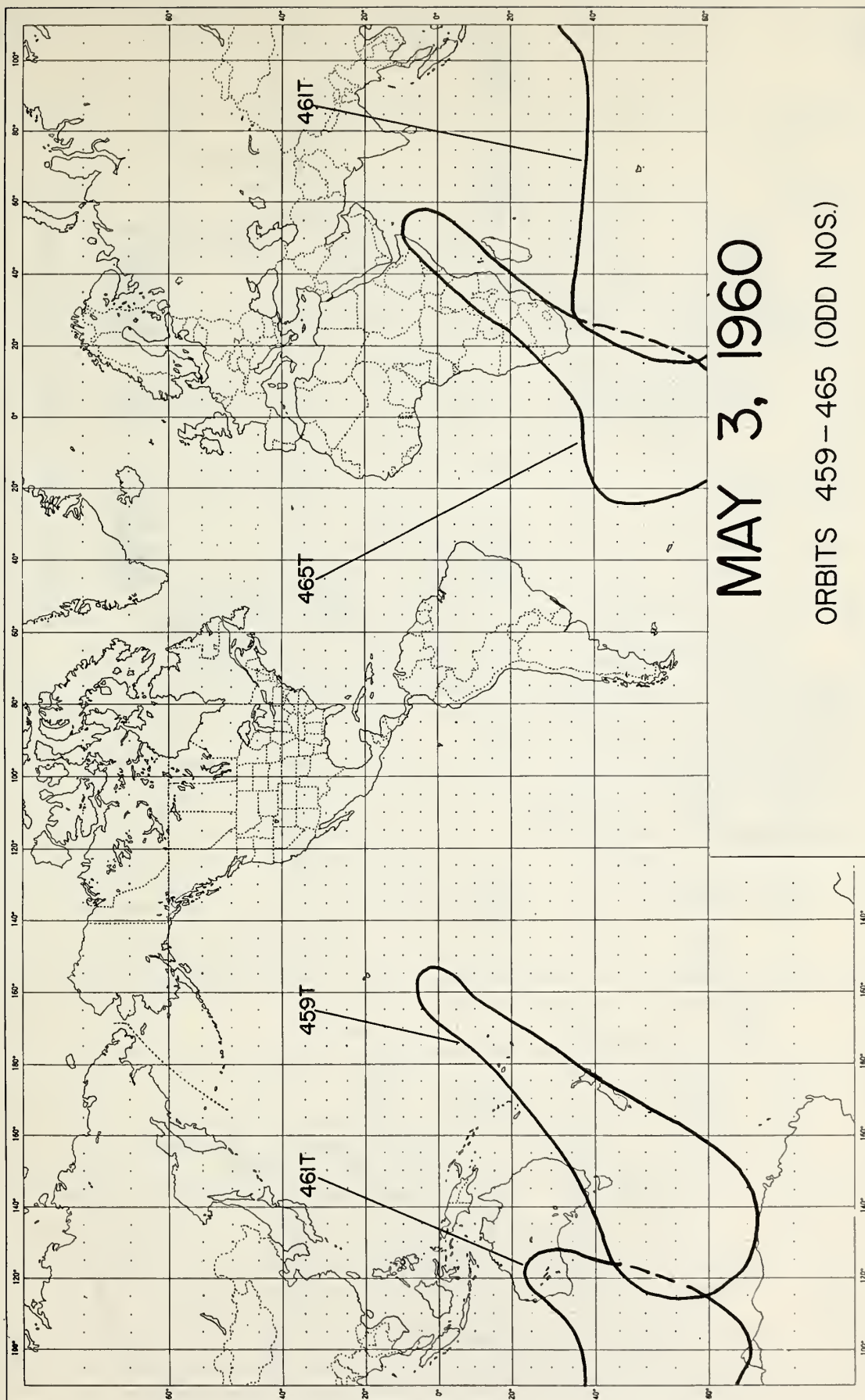
ORBITS 443-451 (ODD NOS.)

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MAY 2, 1960

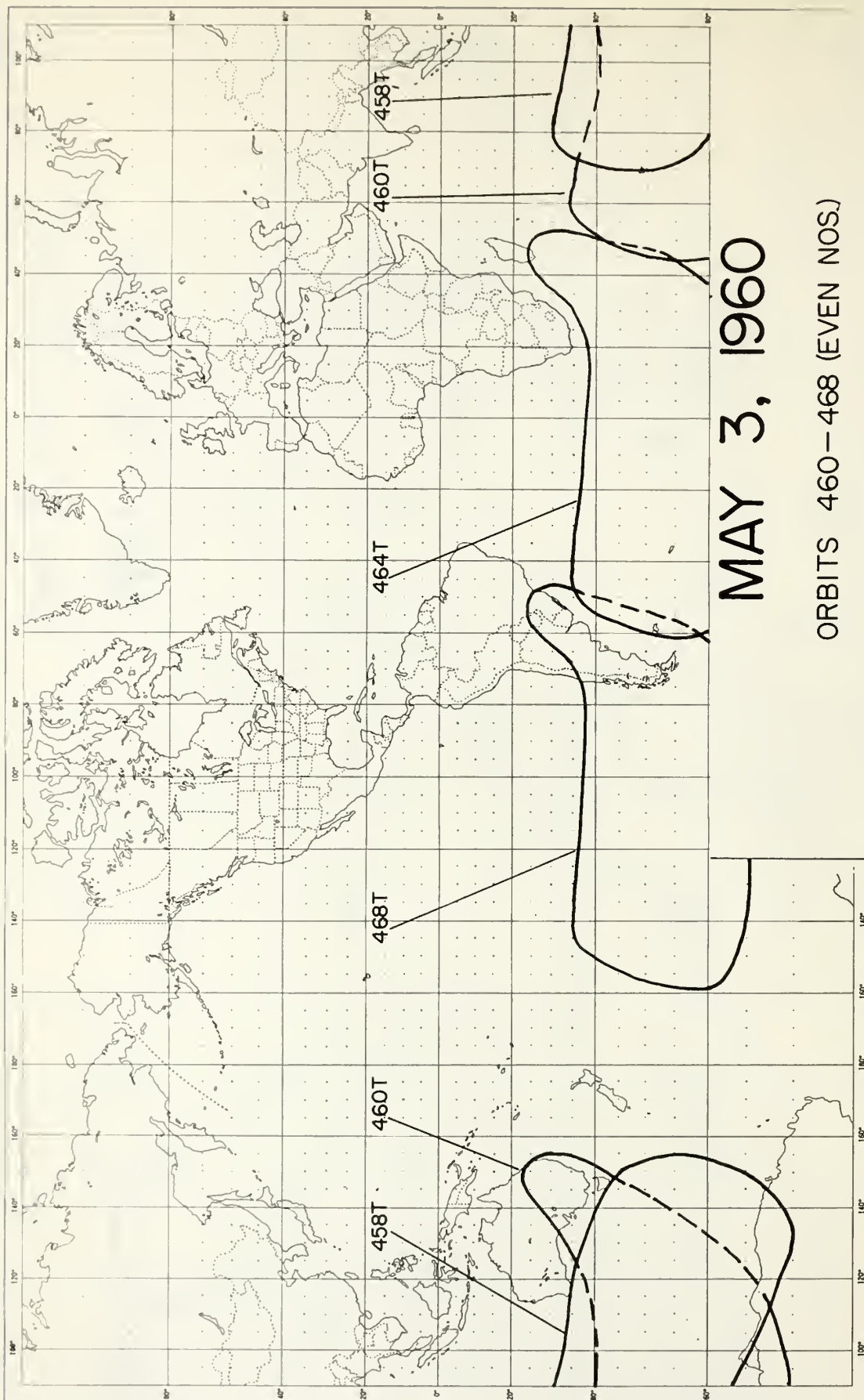
ORBITS 444-454 (EVEN NOS.)



MAY 3, 1960

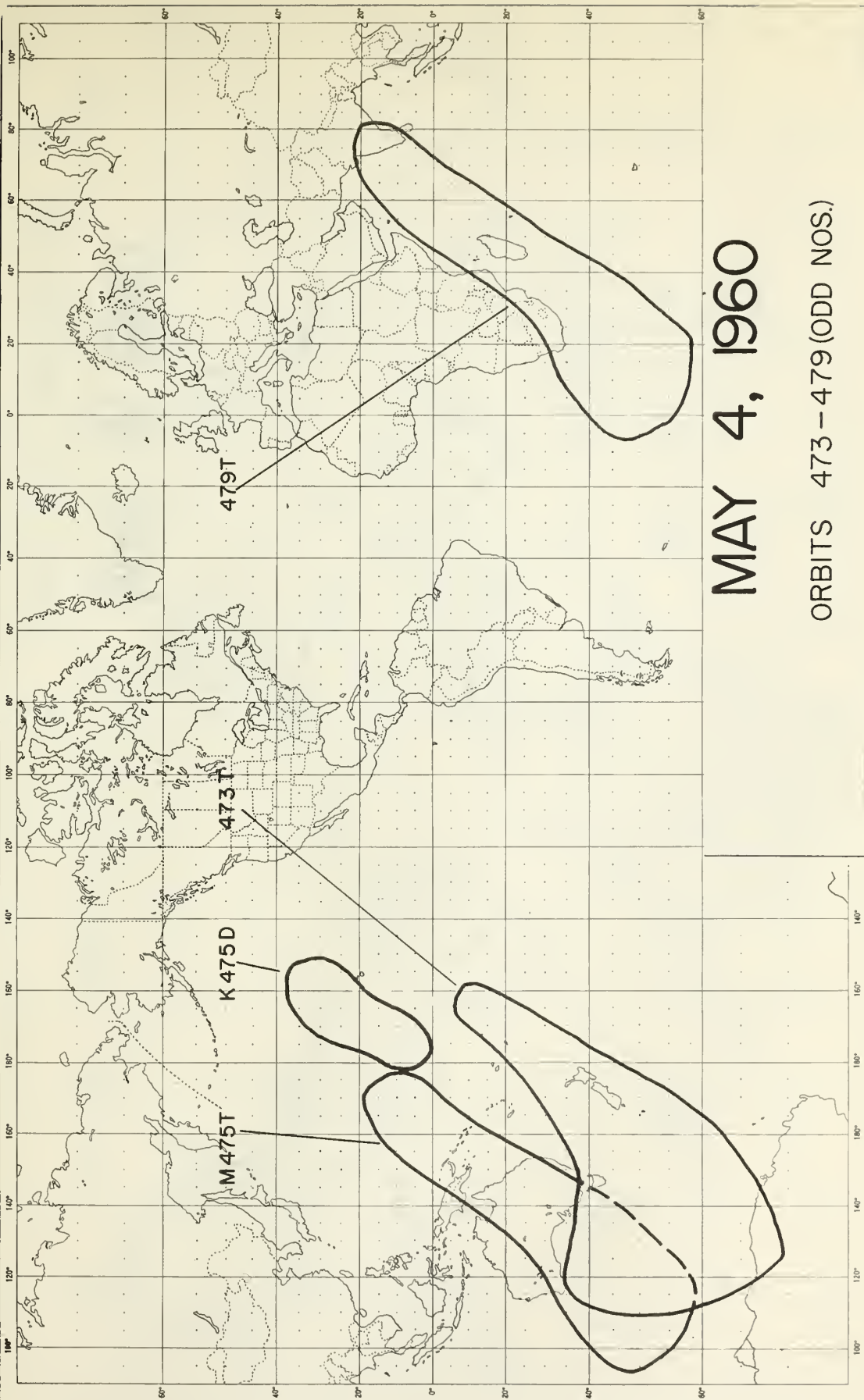
ORBITS 459-465 (ODD NOS.)

USCIB-49-02



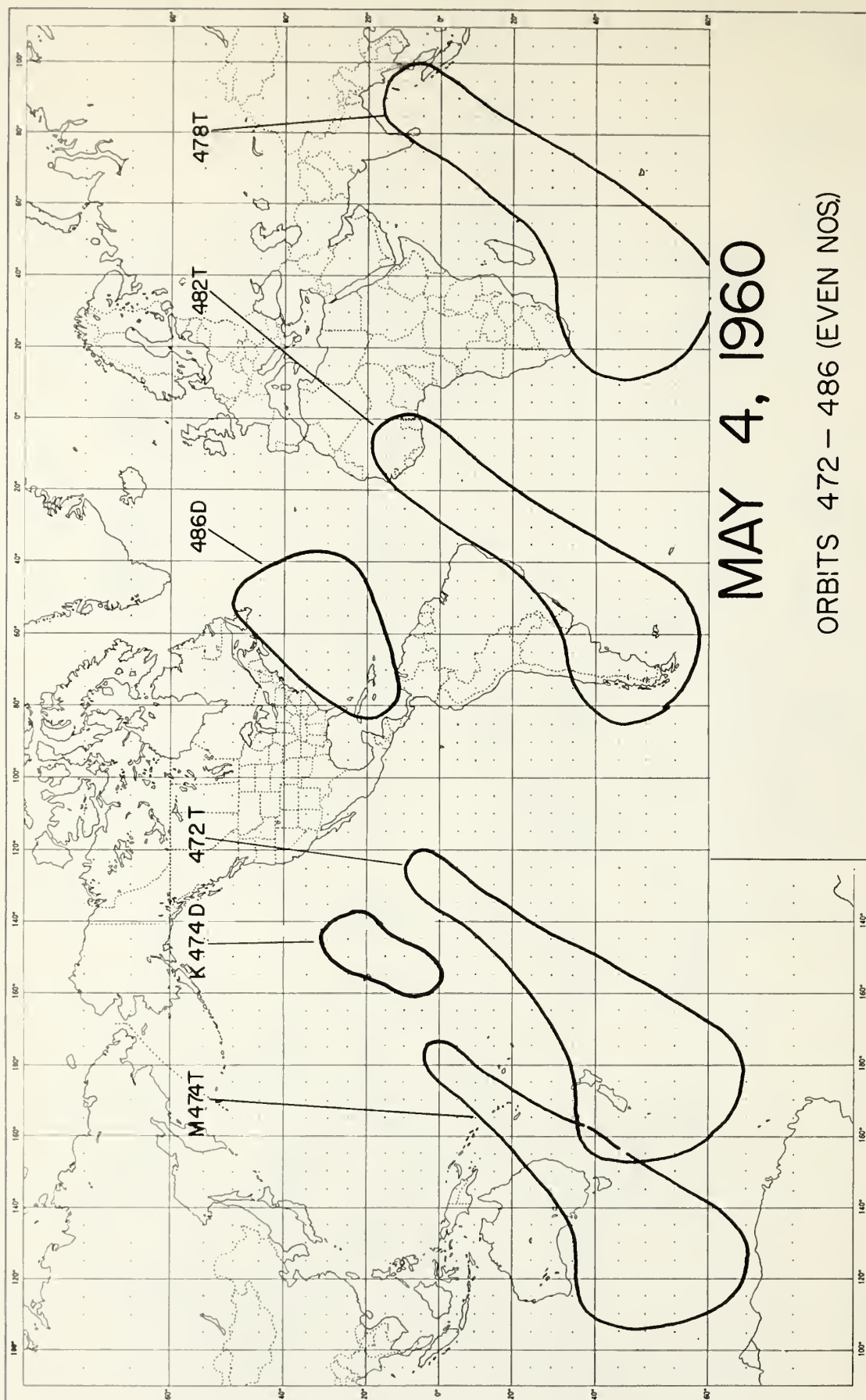
MAY 3, 1960

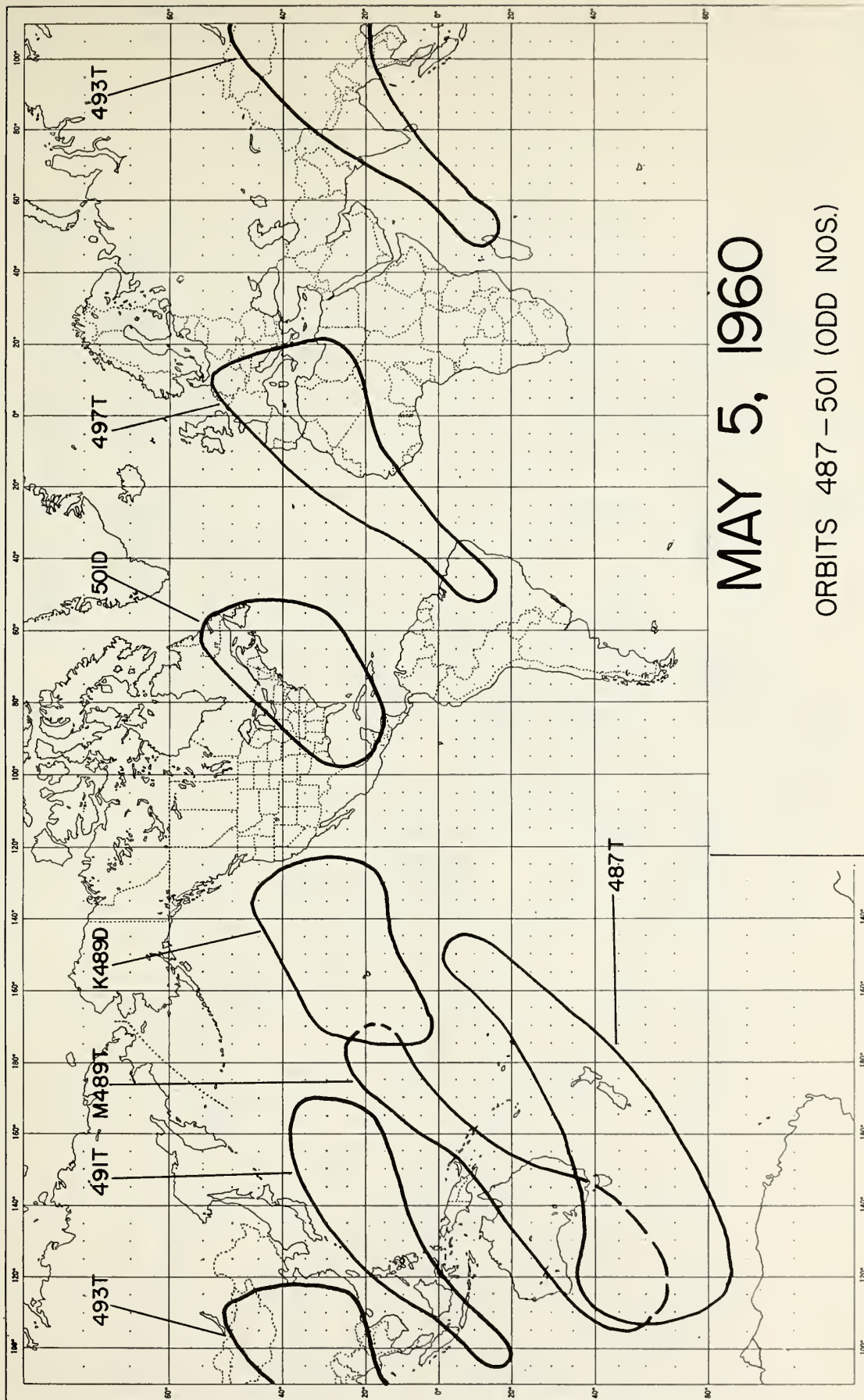
ORBITS 460-468 (EVEN NOS.)



MAY 4, 1960

ORBITS 473-479 (ODD NOS.)

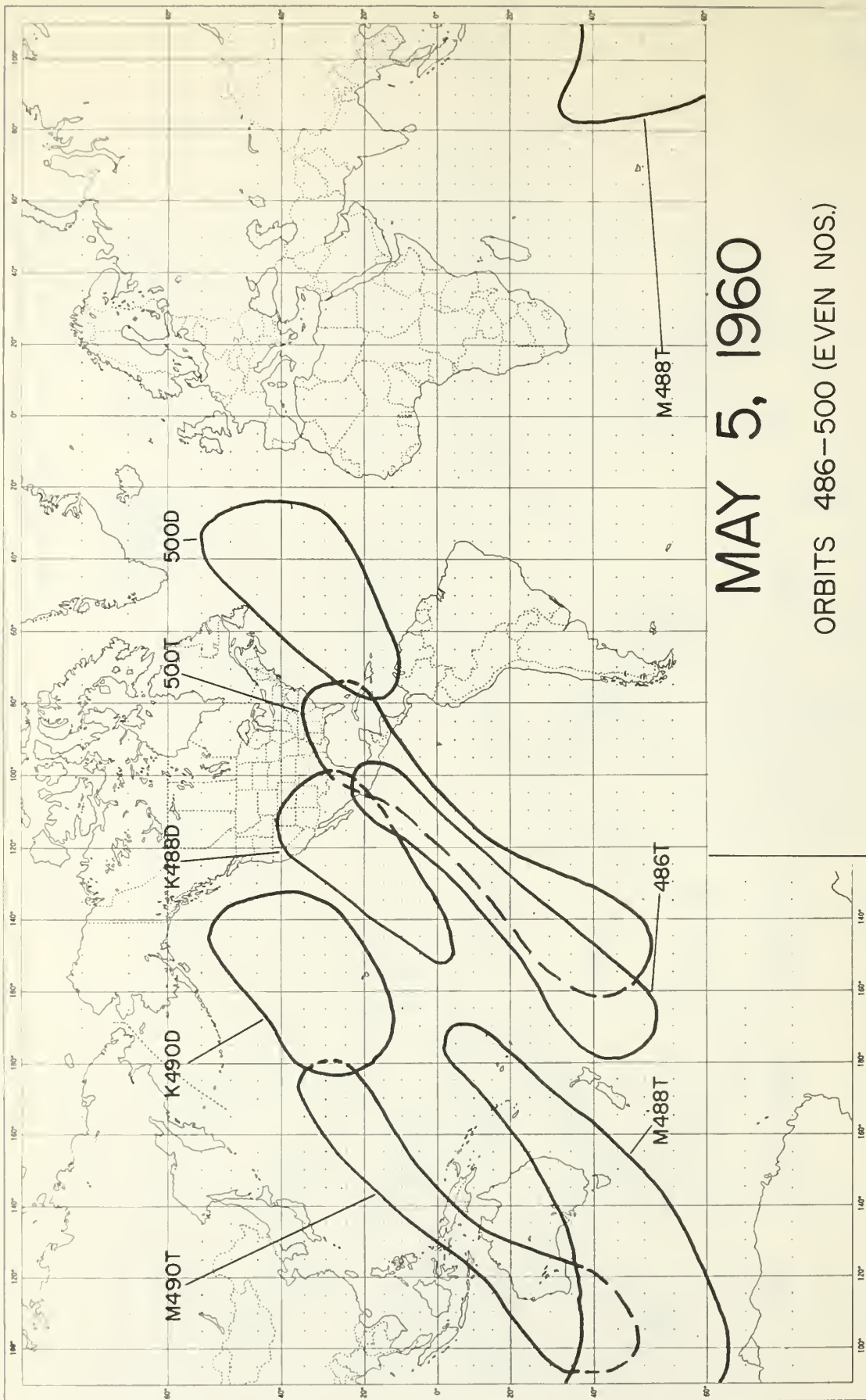




MAY 5, 1960

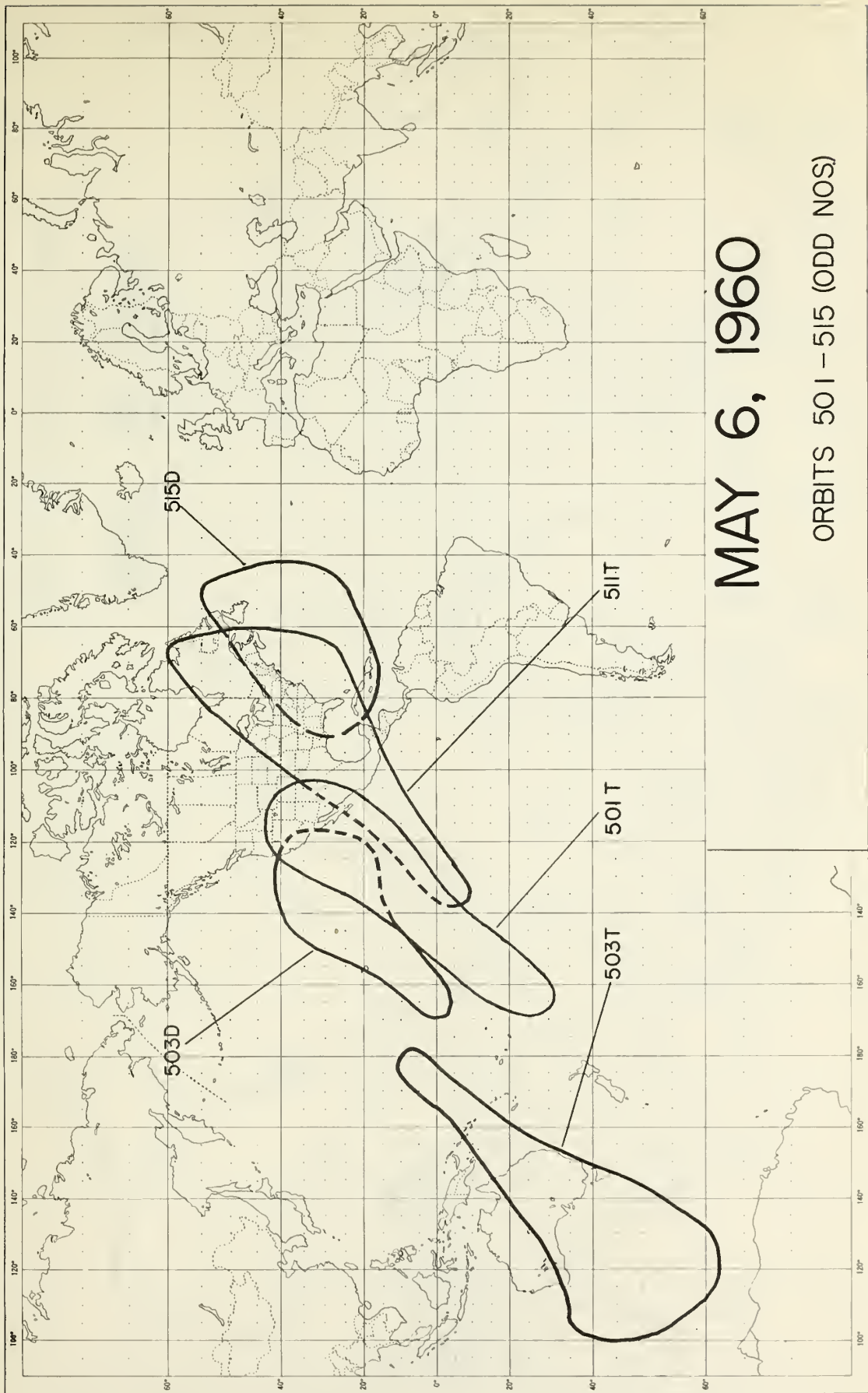
ORBITS 487 - 501 (ODD NOS.)

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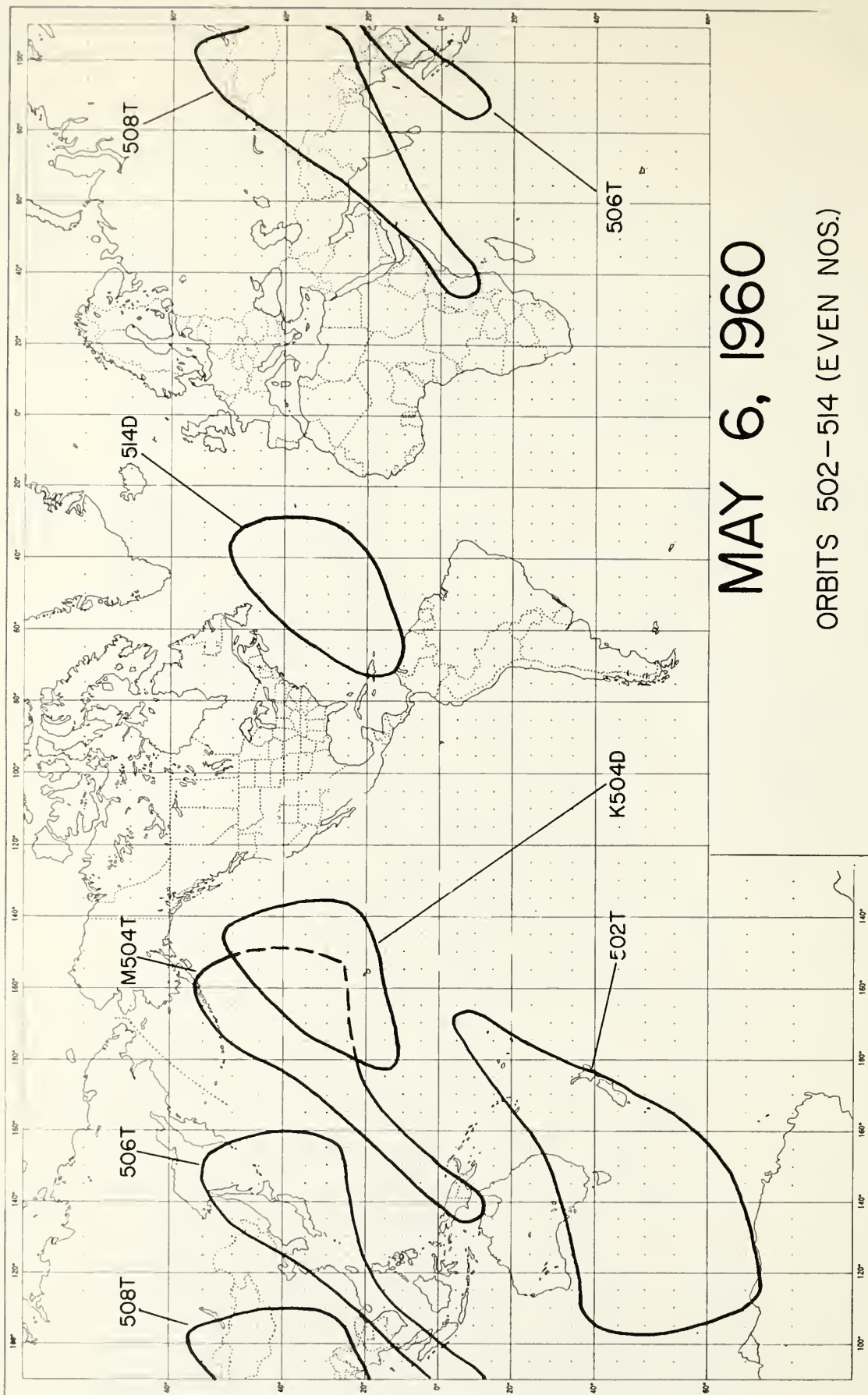
MAY 5, 1960

ORBITS 486-500 (EVEN NOS.)



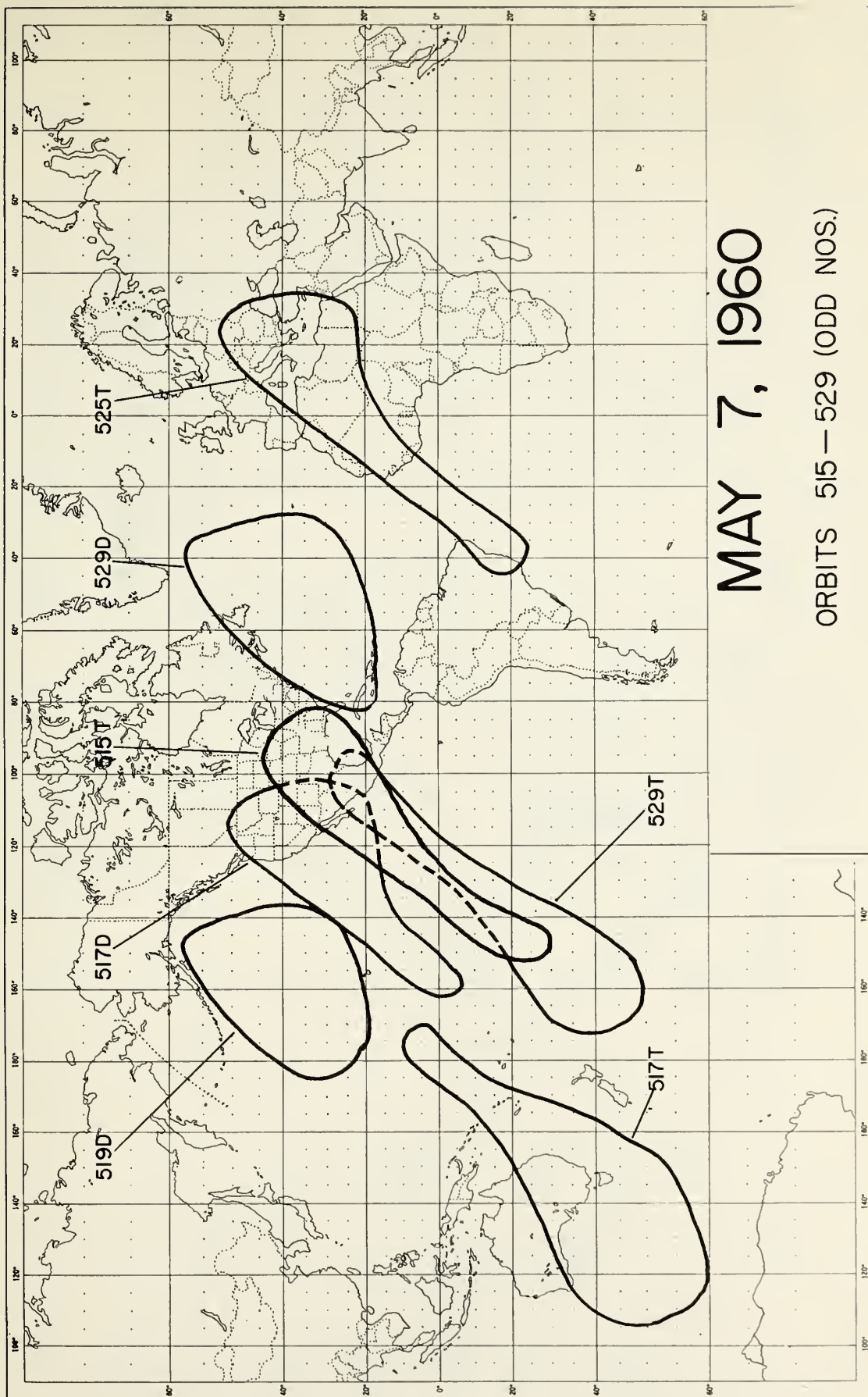
MAY 6, 1960

ORBITS 501 - 515 (ODD NOS)



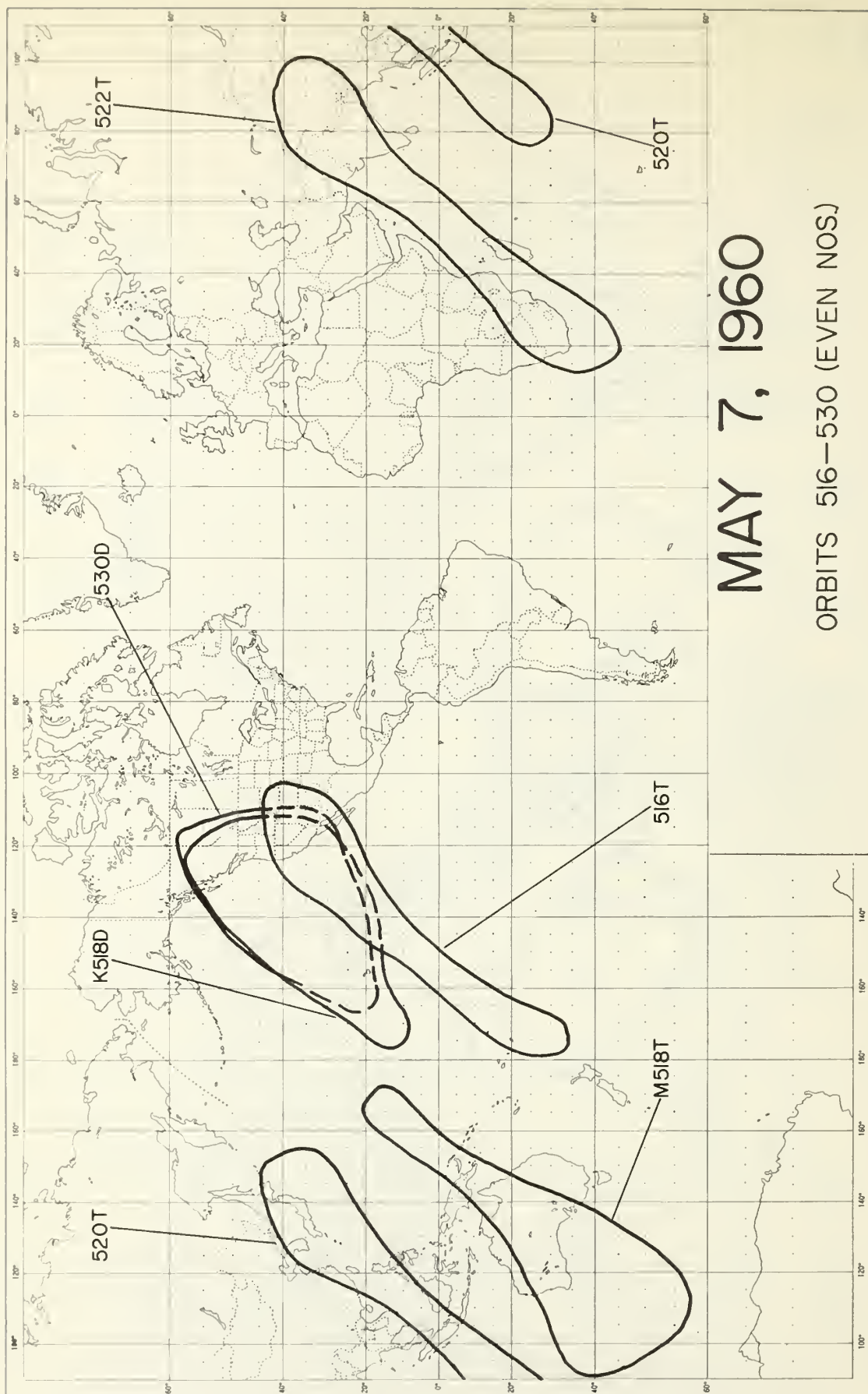
MAY 6, 1960

ORBITS 502-514 (EVEN NOS.)

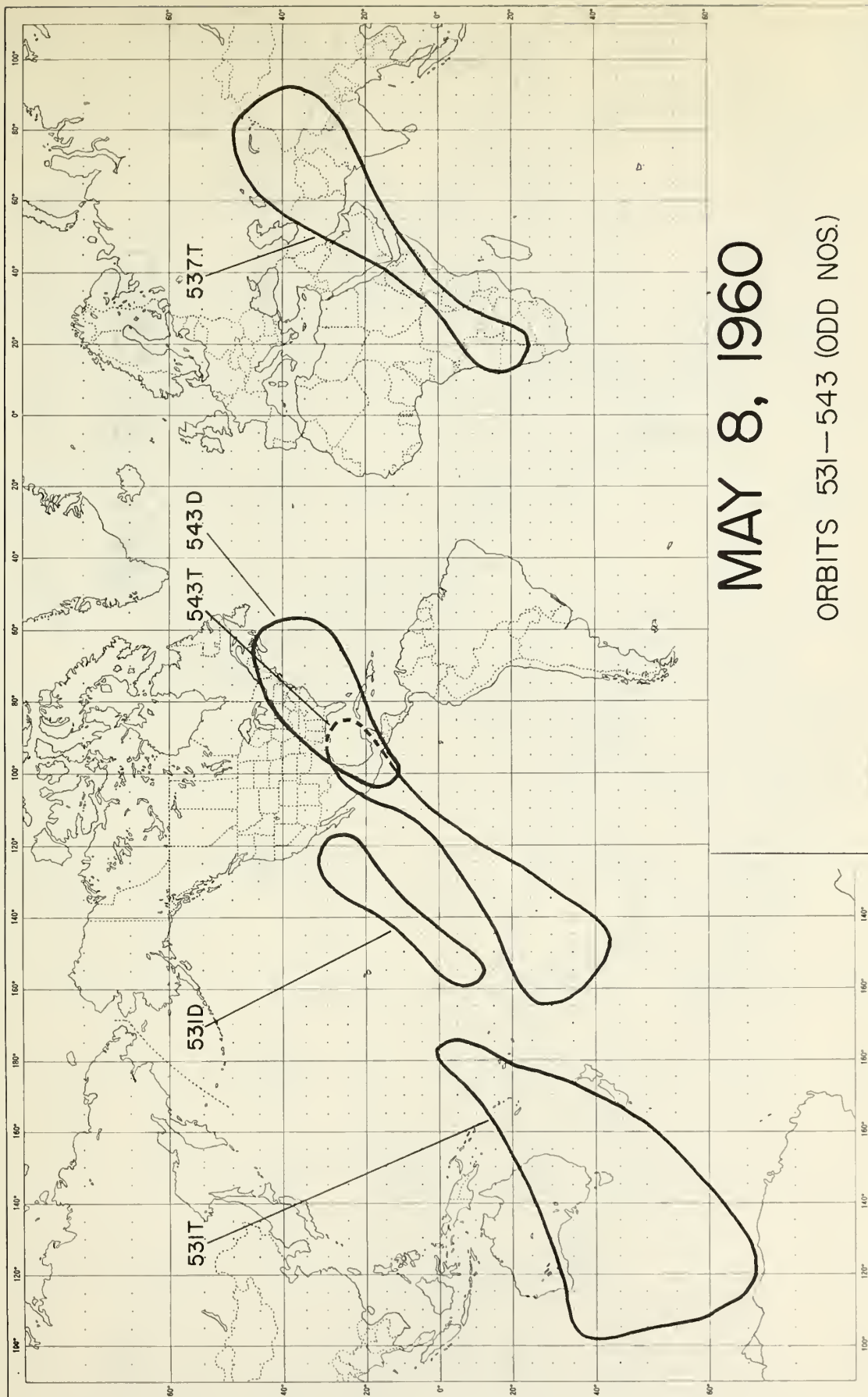


MAY 7, 1960

ORBITS 515 — 529 (ODD NOS.)



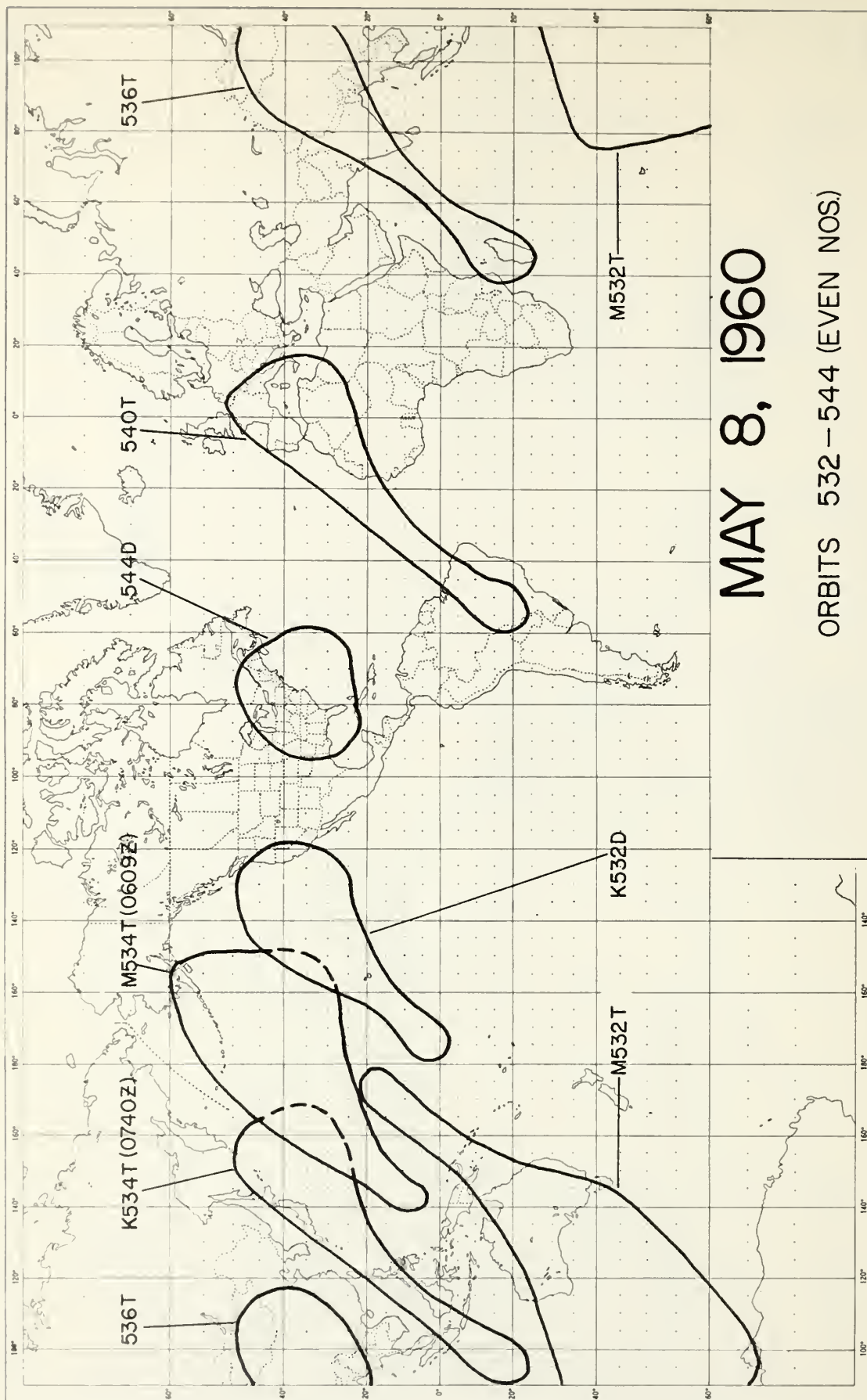
MAY 7, 1960
 ORBITS 516—530 (EVEN NOS)



MAY 8, 1960

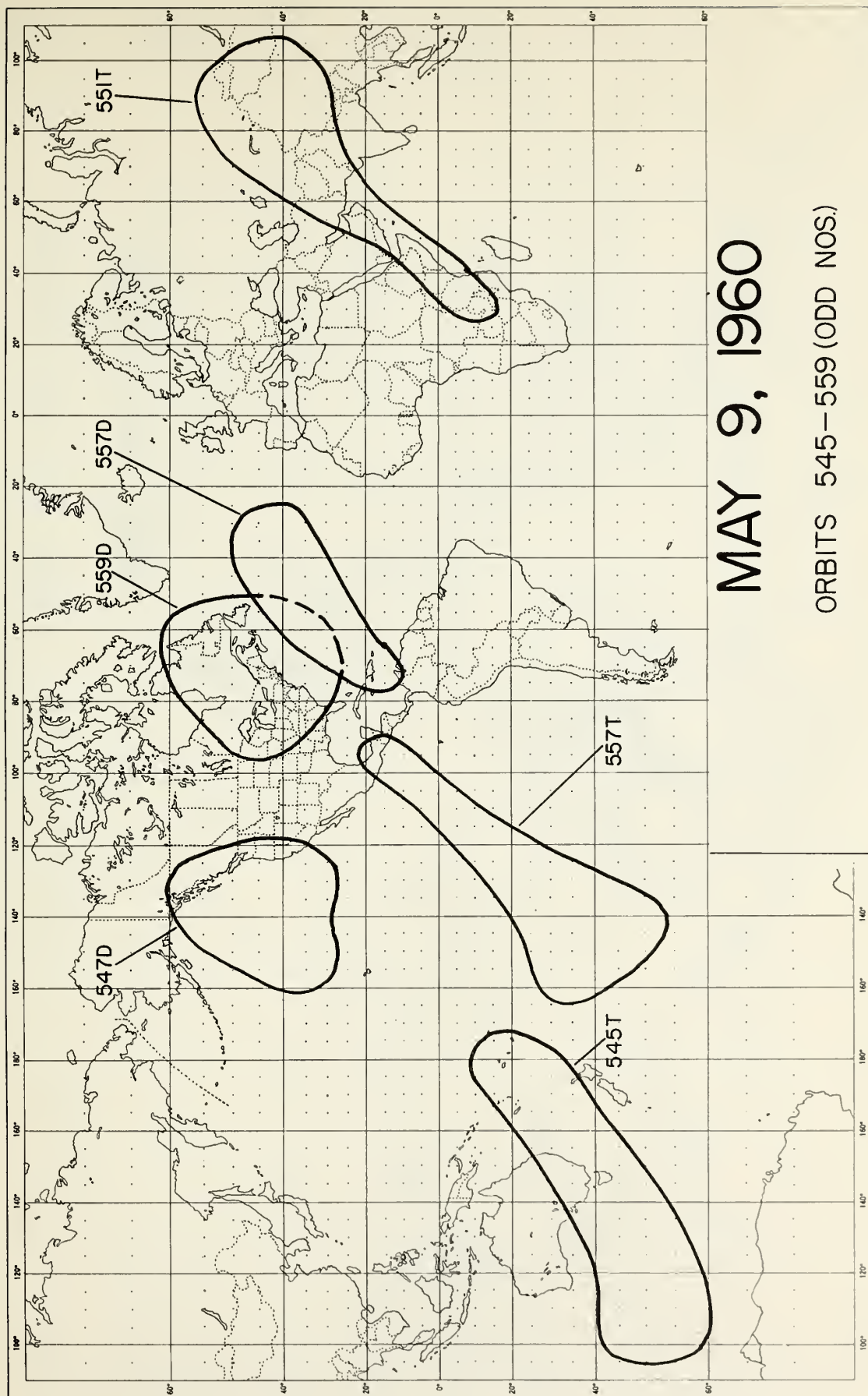
ORBITS 531-543 (ODD NOS.)

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MAY 8, 1960

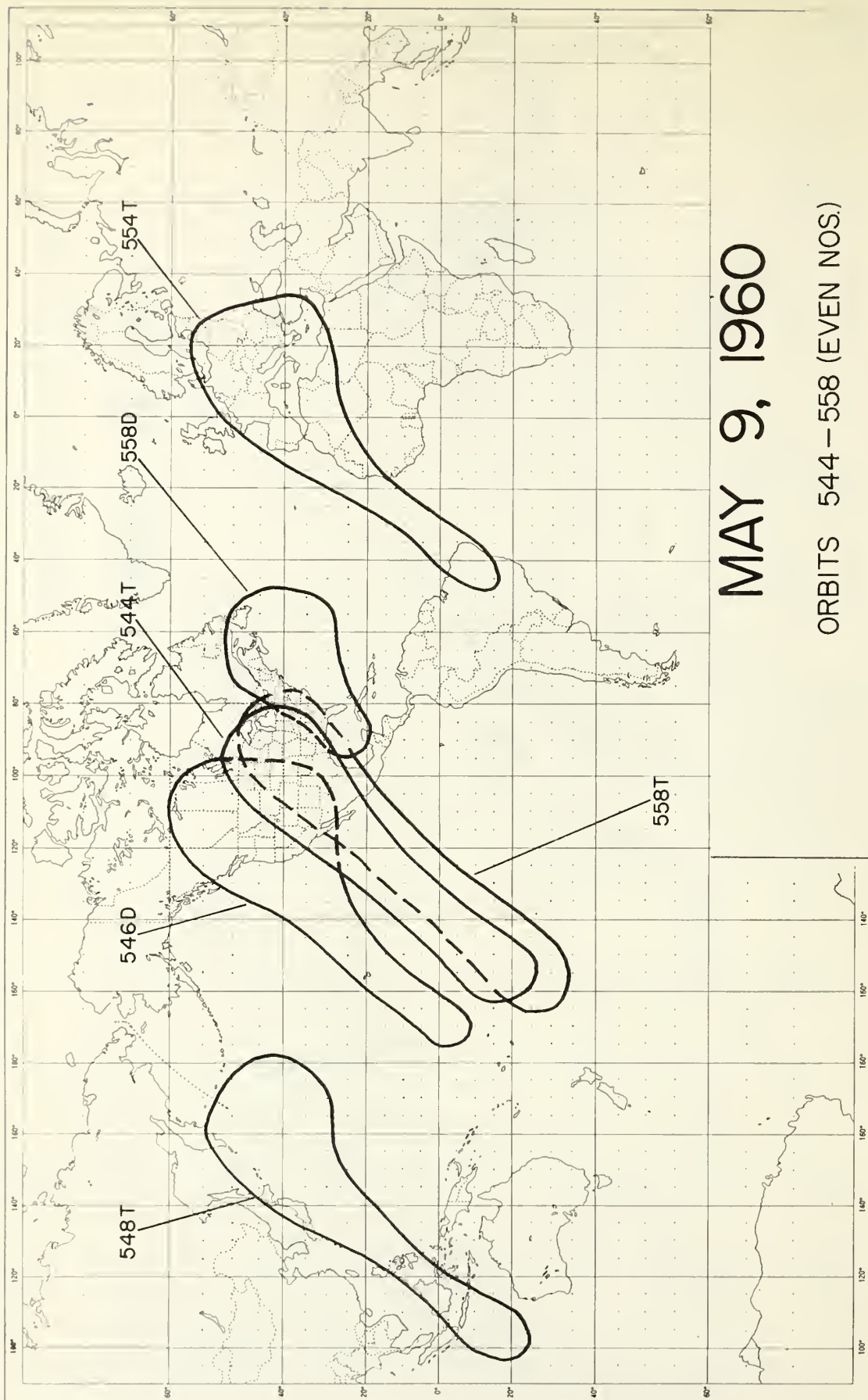
ORBITS 532-544 (EVEN NOS)

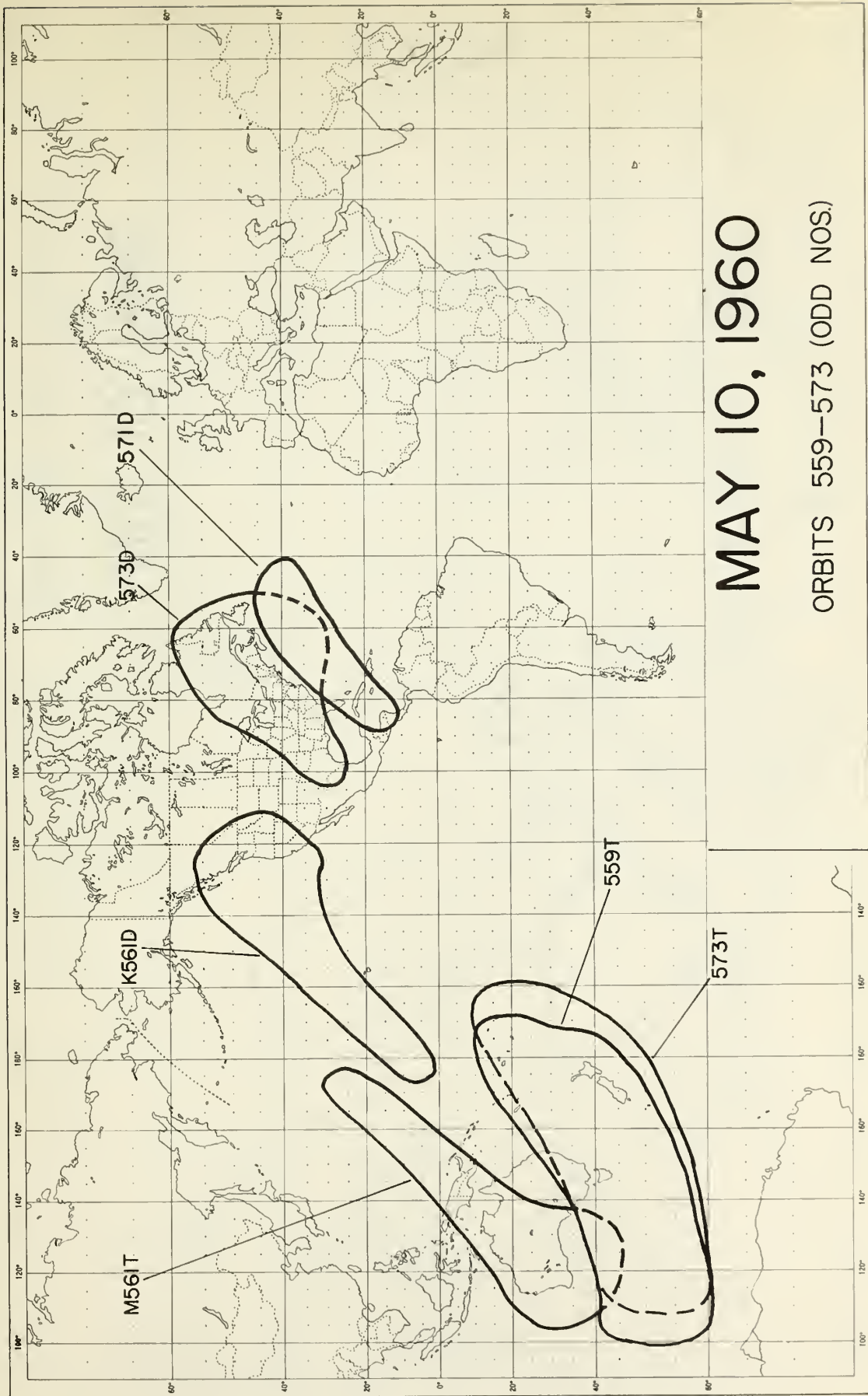


MAY 9, 1960

ORBITS 545—559 (ODD NOS.)

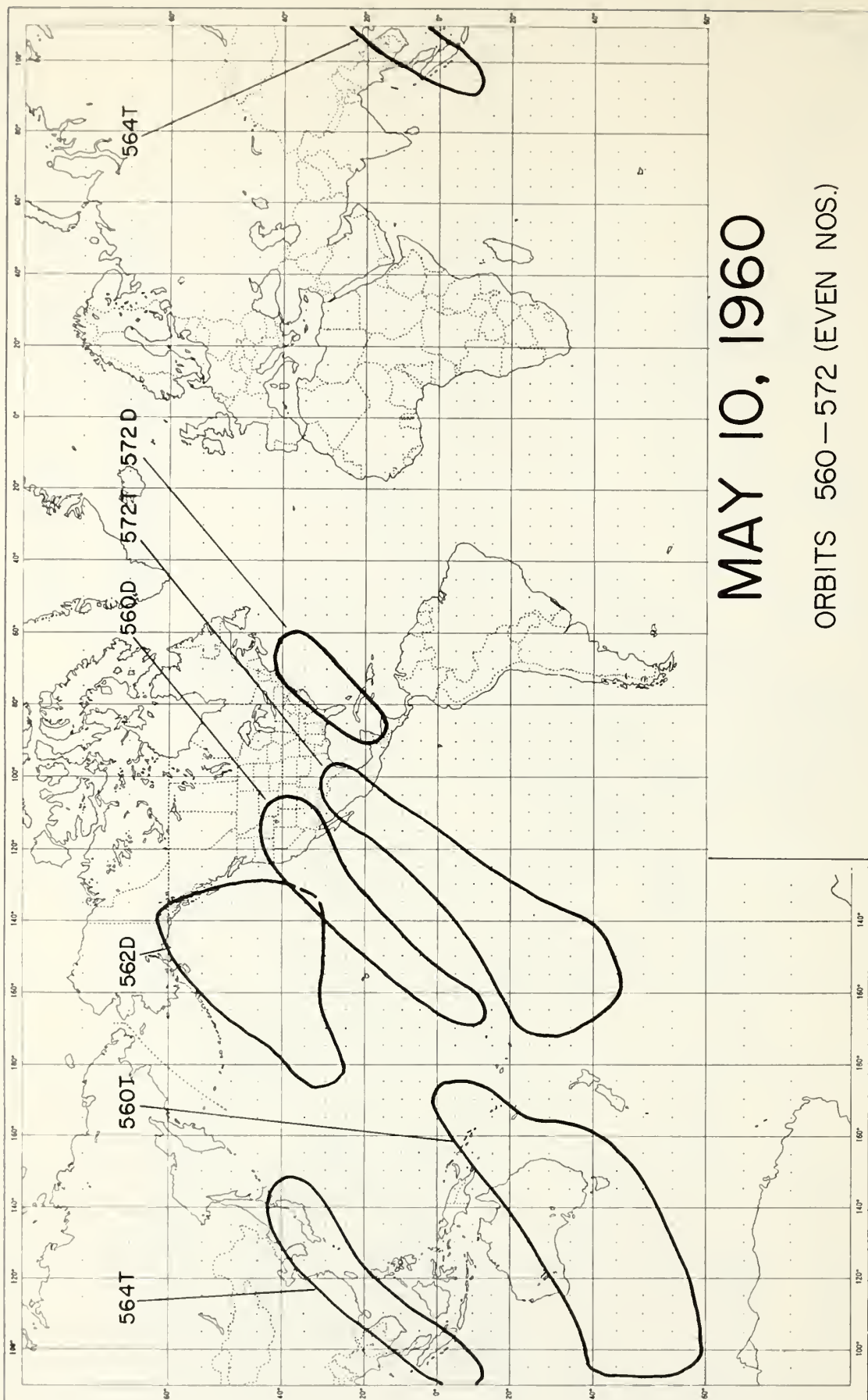
U.S. GOVERNMENT PRINTING OFFICE





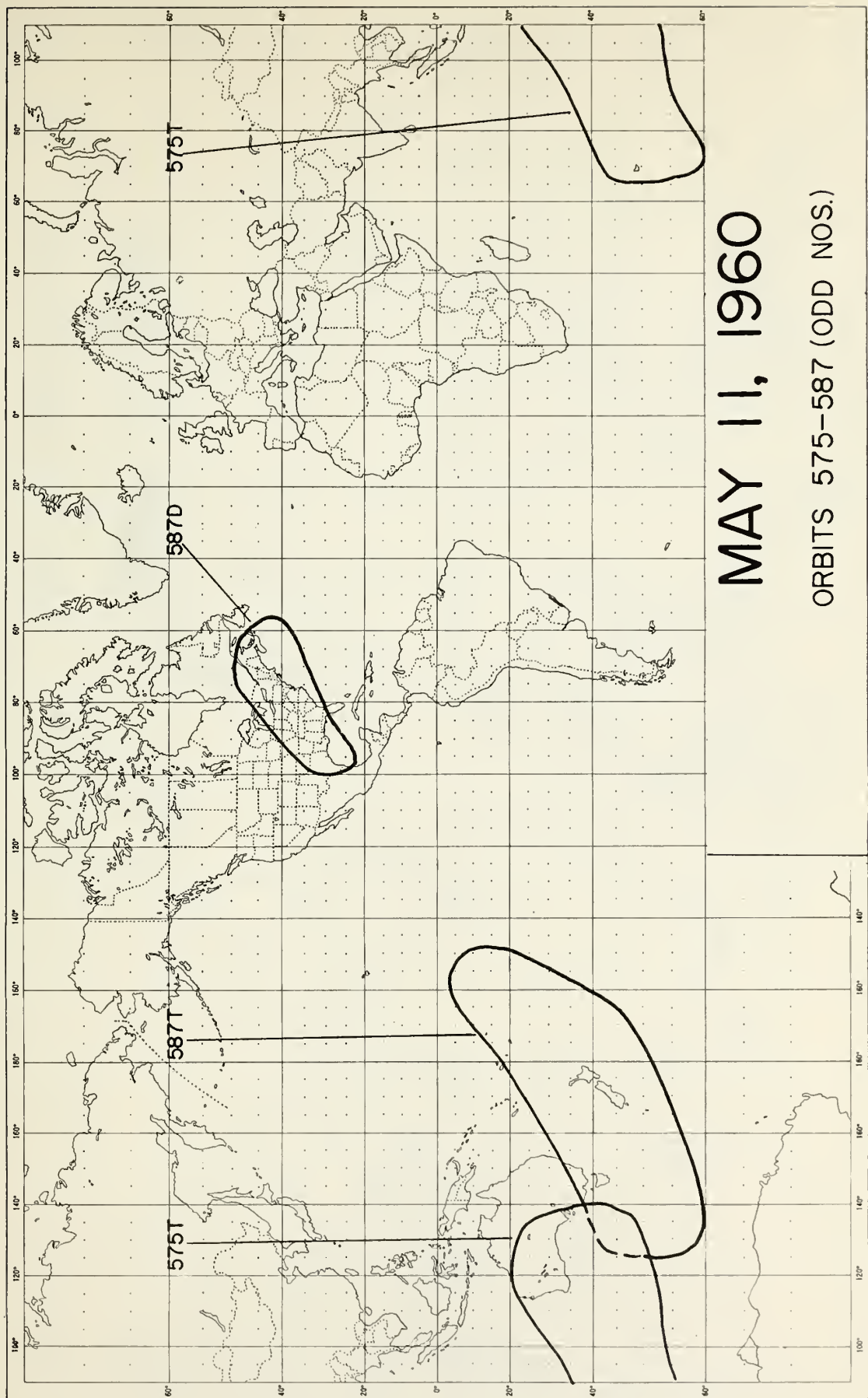
MAY 10, 1960

ORBITS 559-573 (ODD NOS.)



MAY 10, 1960

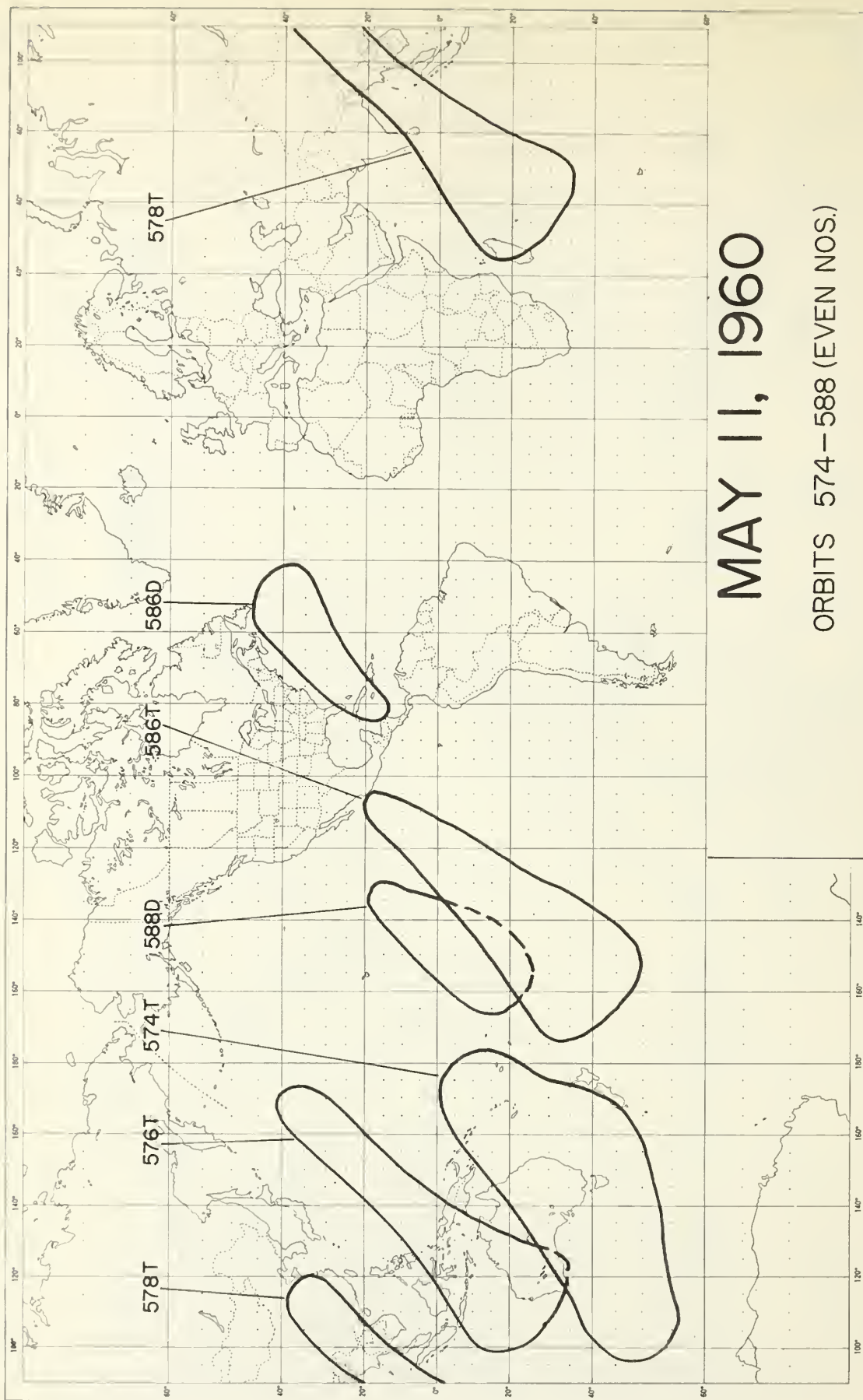
ORBITS 560-572 (EVEN NOS.)



MAY 11, 1960

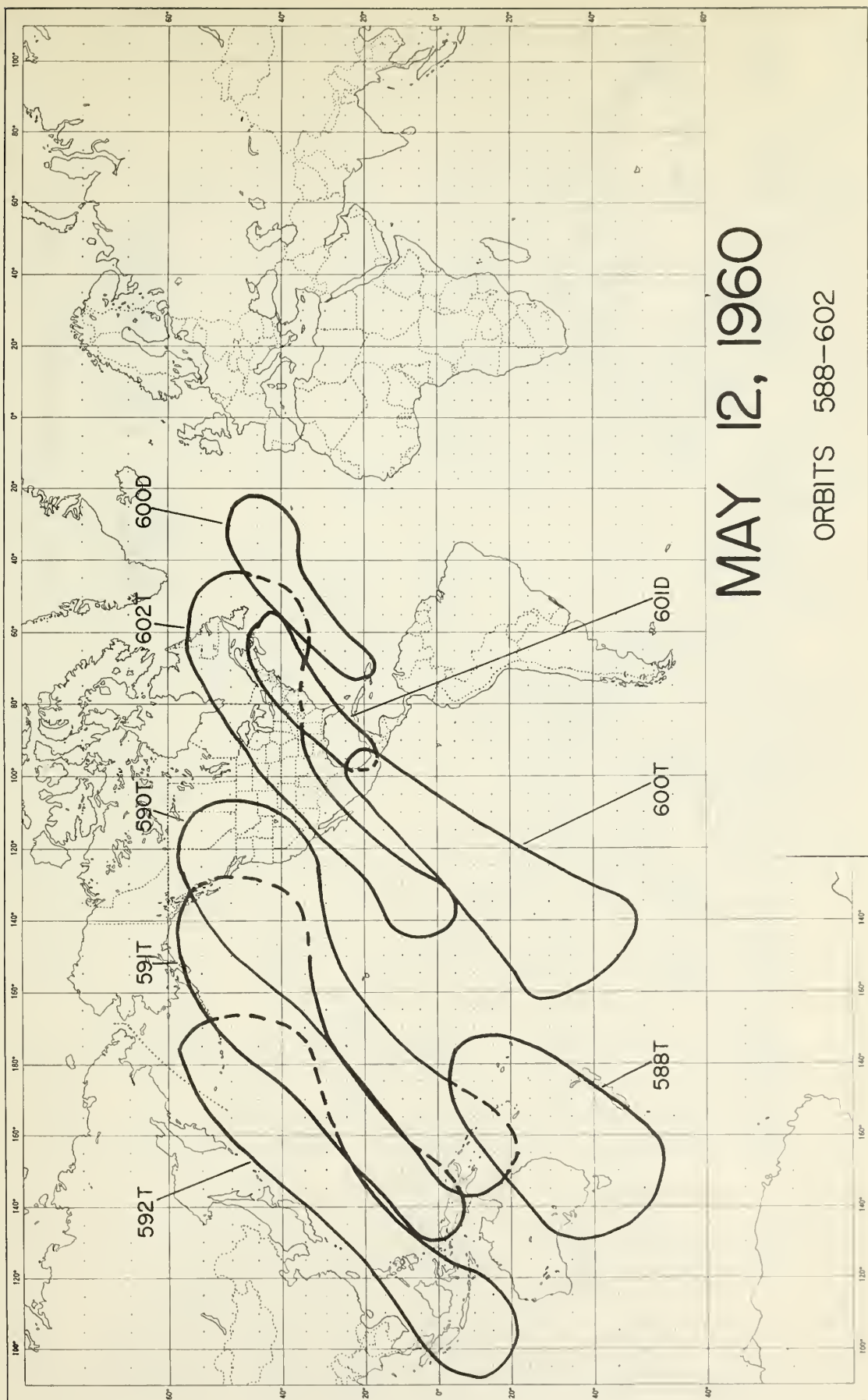
ORBITS 575-587 (ODD NOS.)

13-57044-48-00



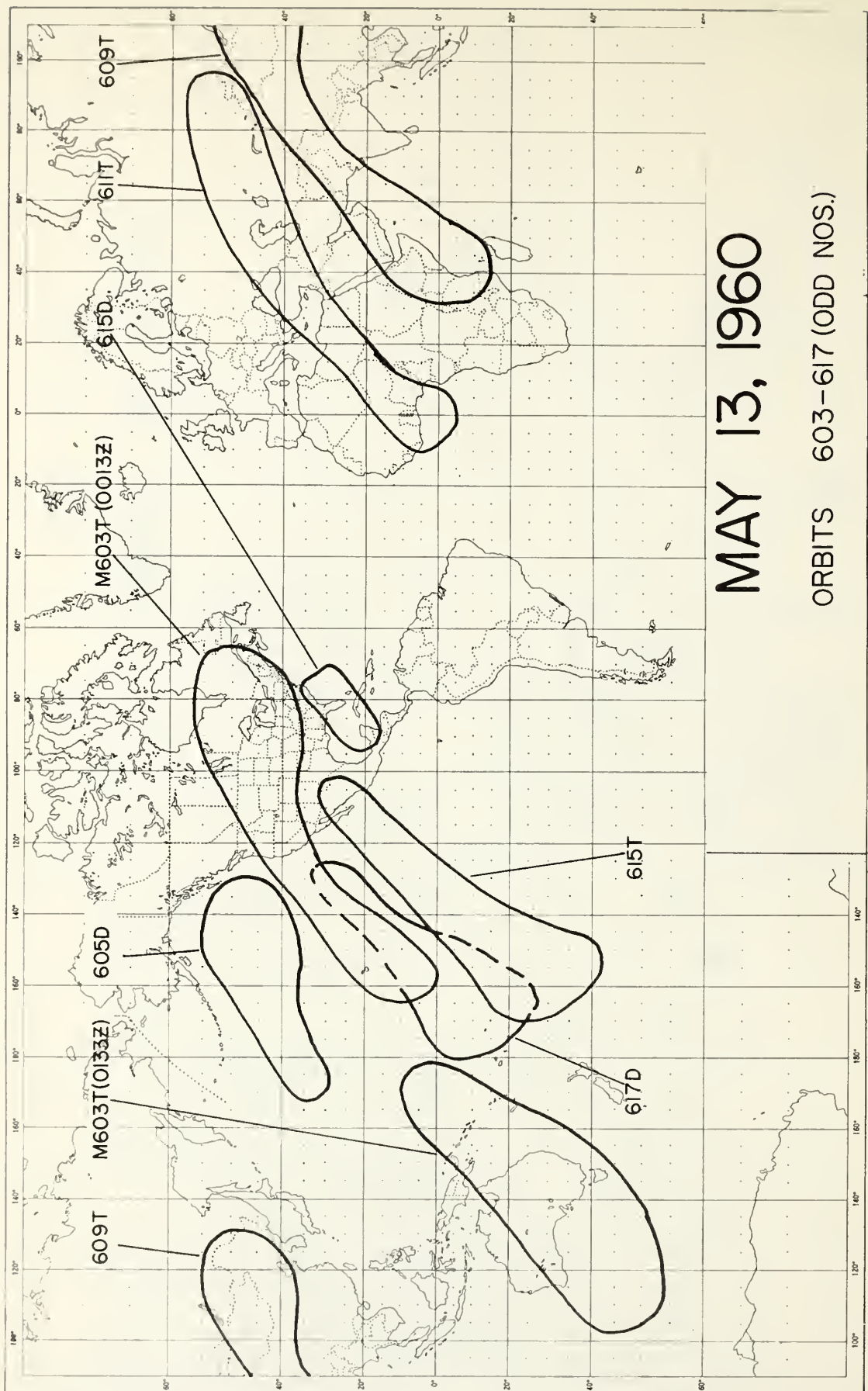
MAY 11, 1960

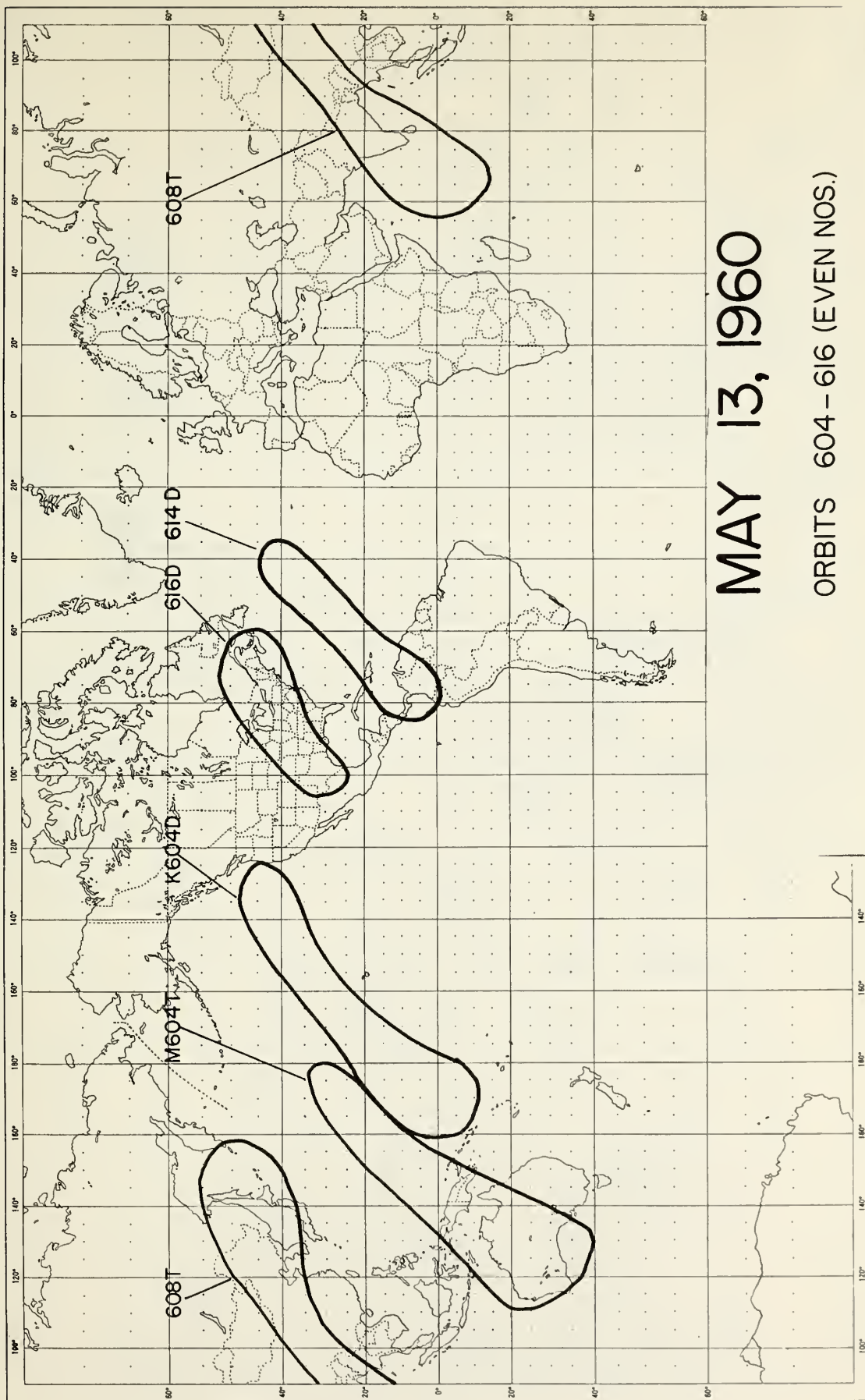
ORBITS 574-588 (EVEN NOS.)



MAY 12, 1960

ORBITS 588-602

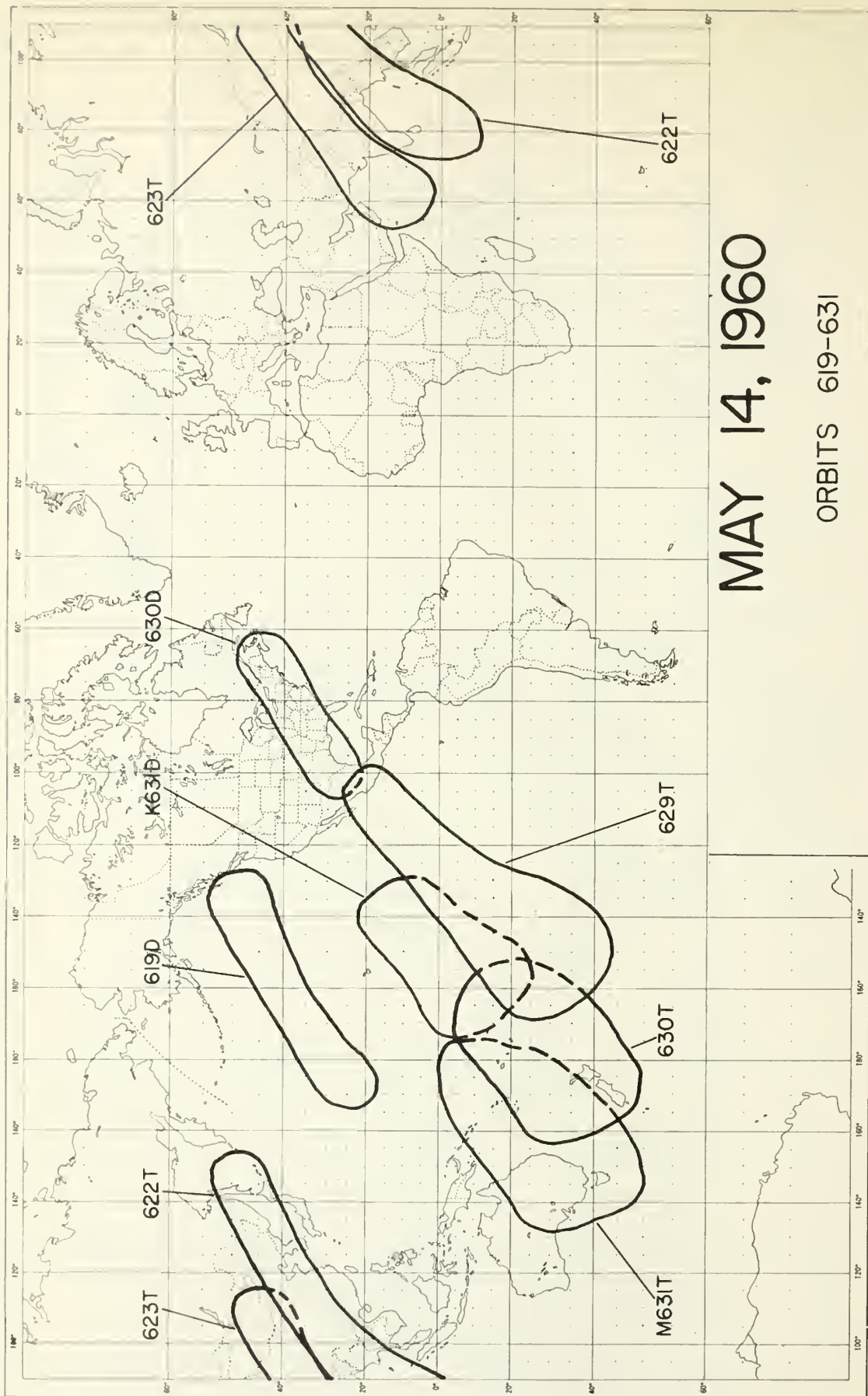




MAY 13, 1960

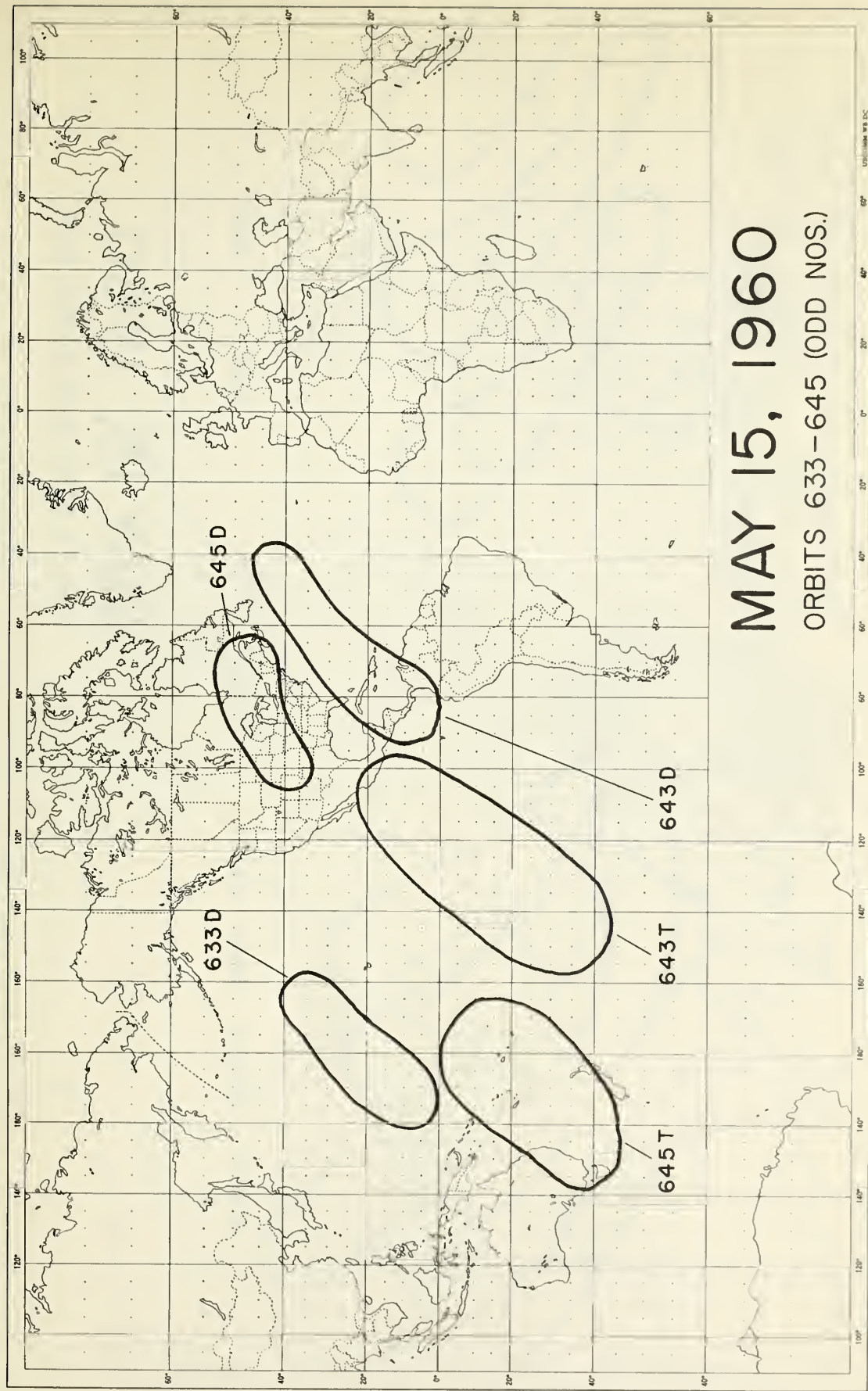
ORBITS 604 - 616 (EVEN NOS.)

USCNAV-9-2C

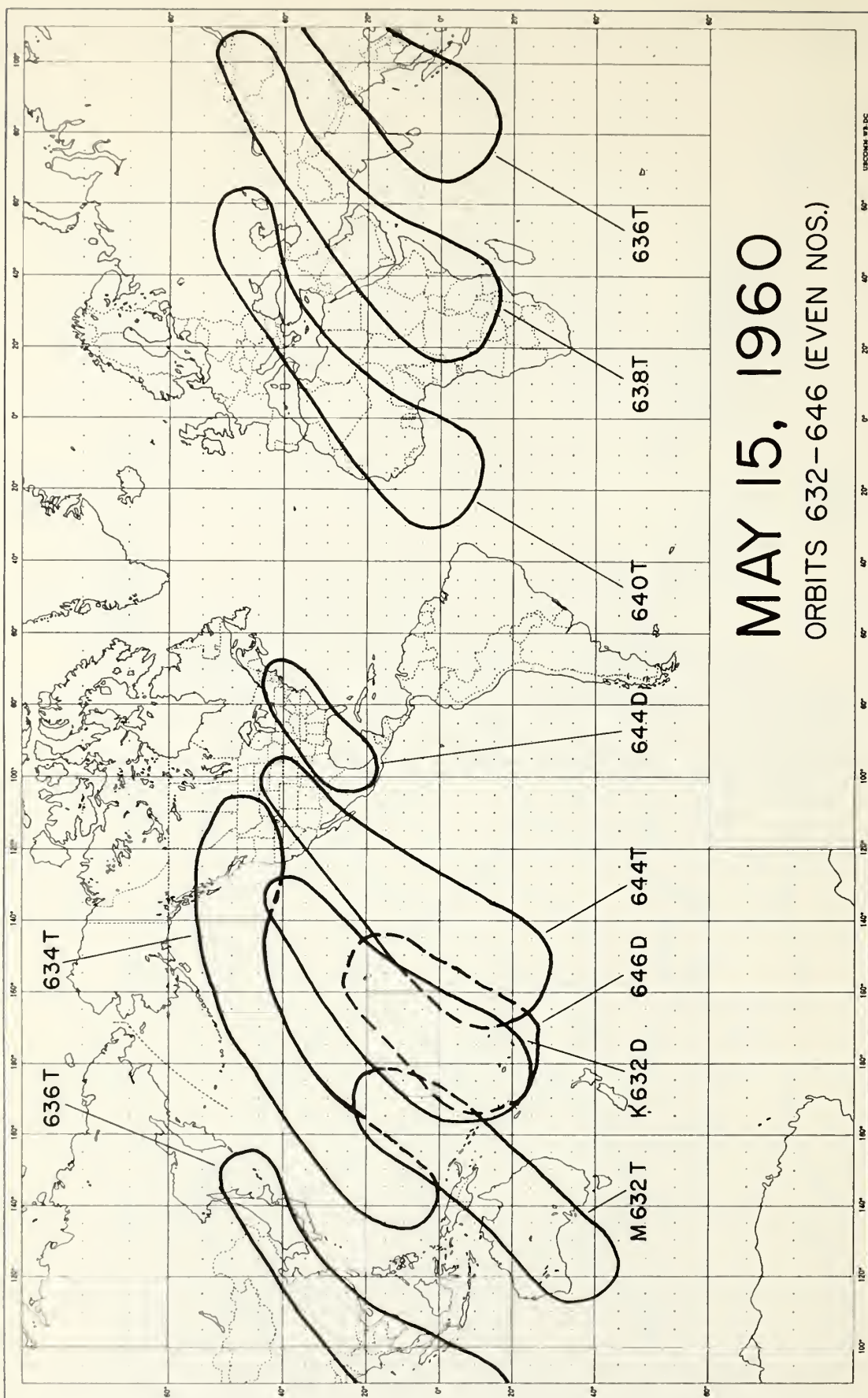


MAY 14, 1960

ORBITS 619-631

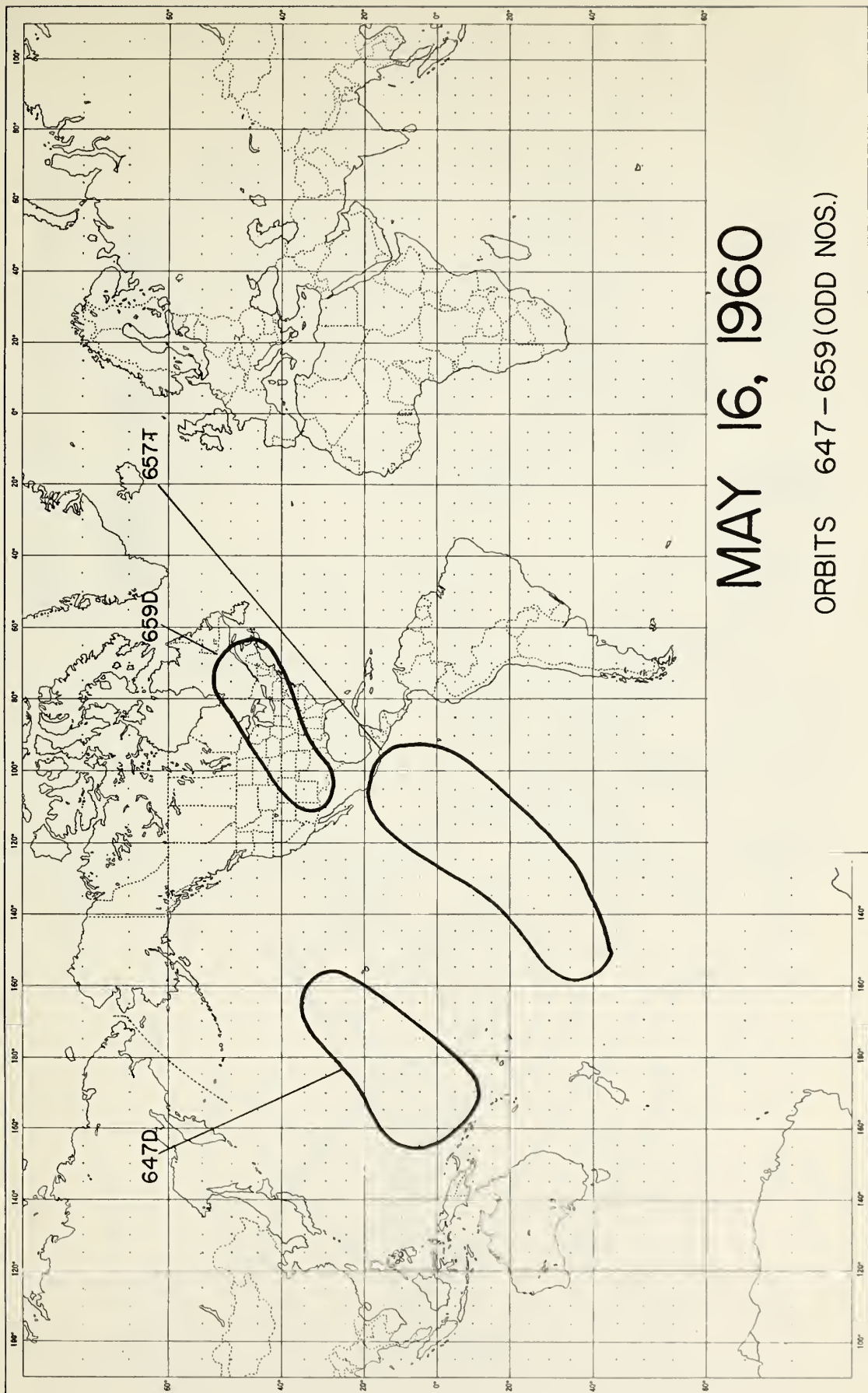


MAY 15, 1960
ORBITS 633-645 (ODD NOS.)



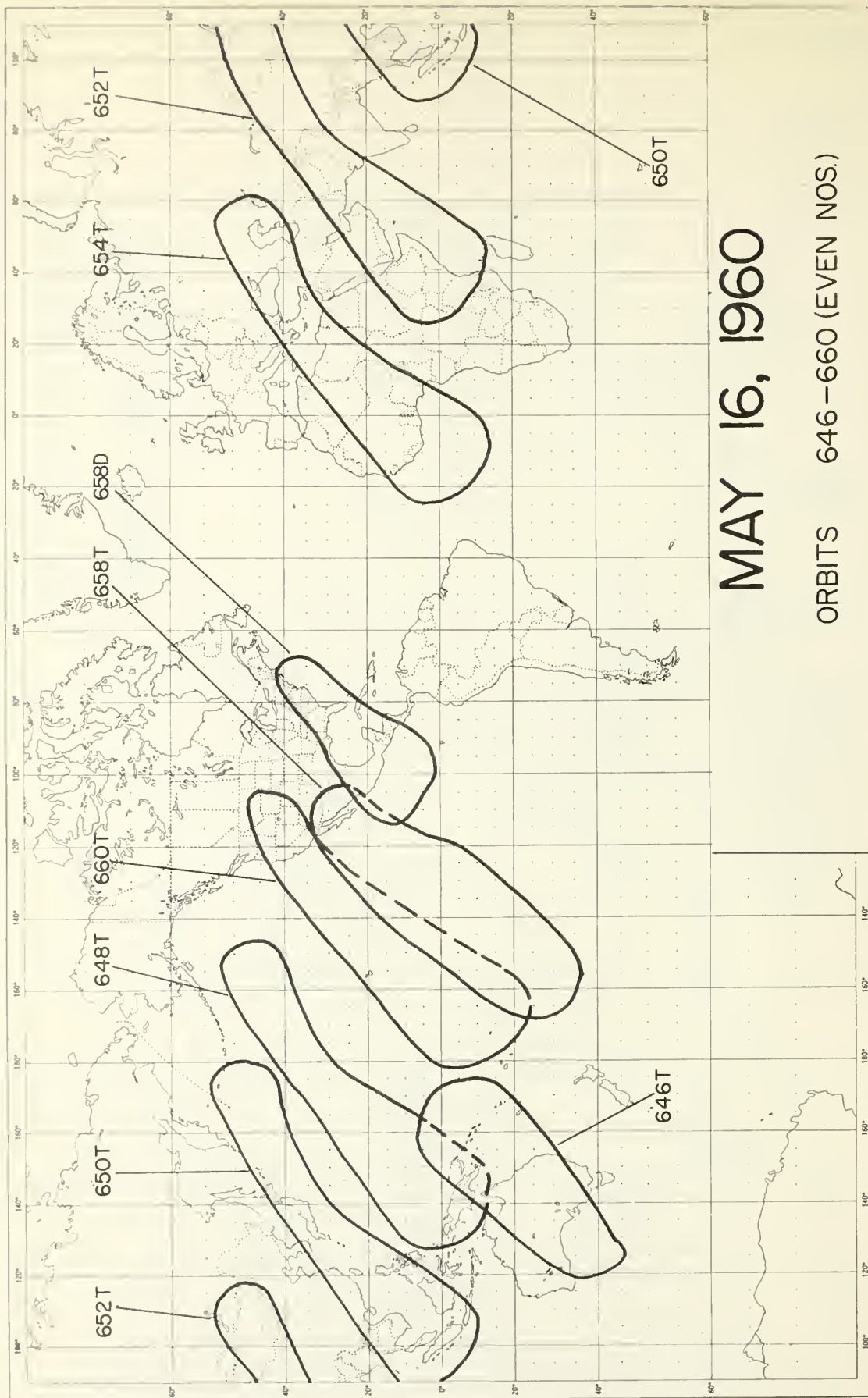
MAY 15, 1960

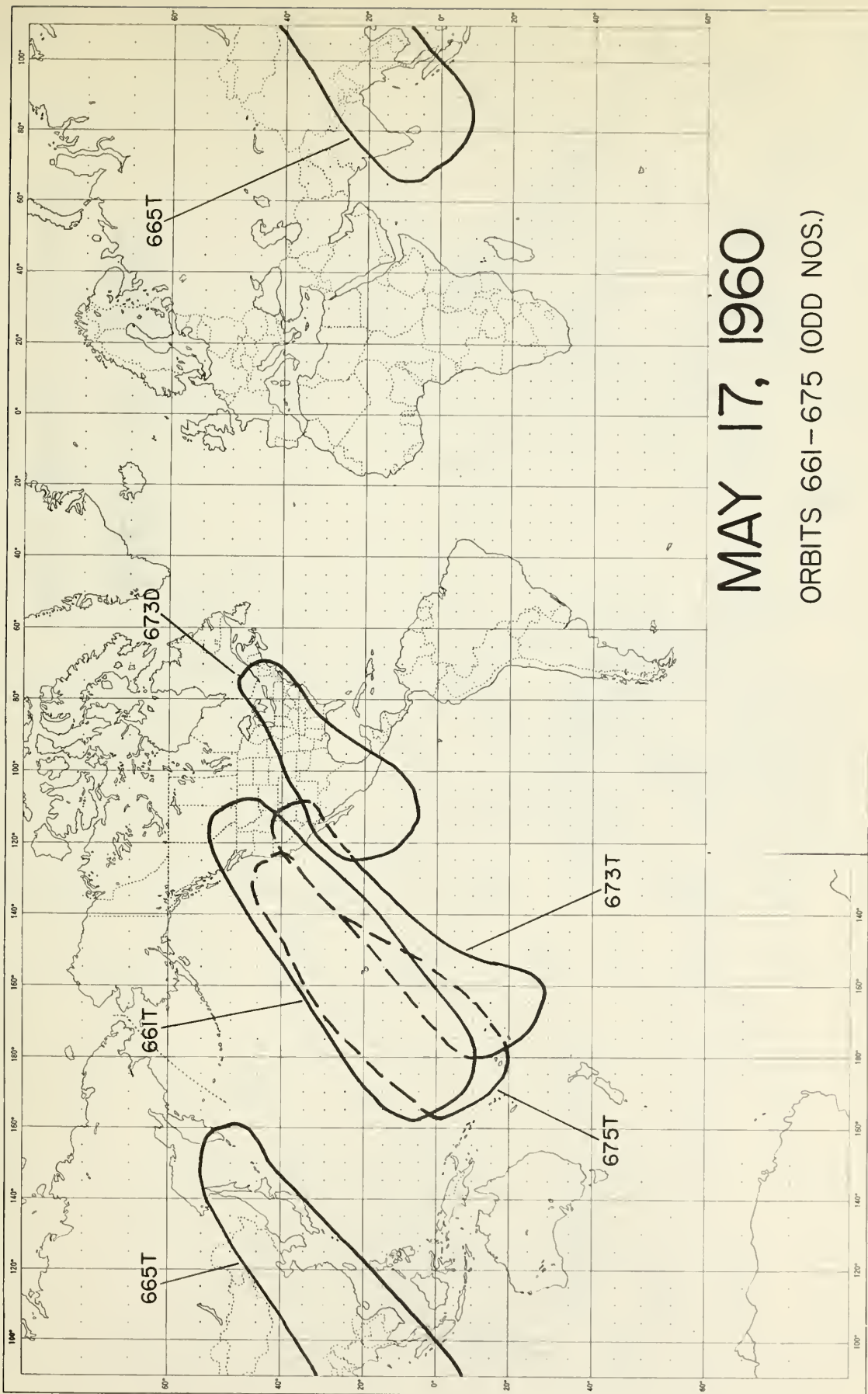
ORBITS 632-646 (EVEN NOS.)



MAY 16, 1960

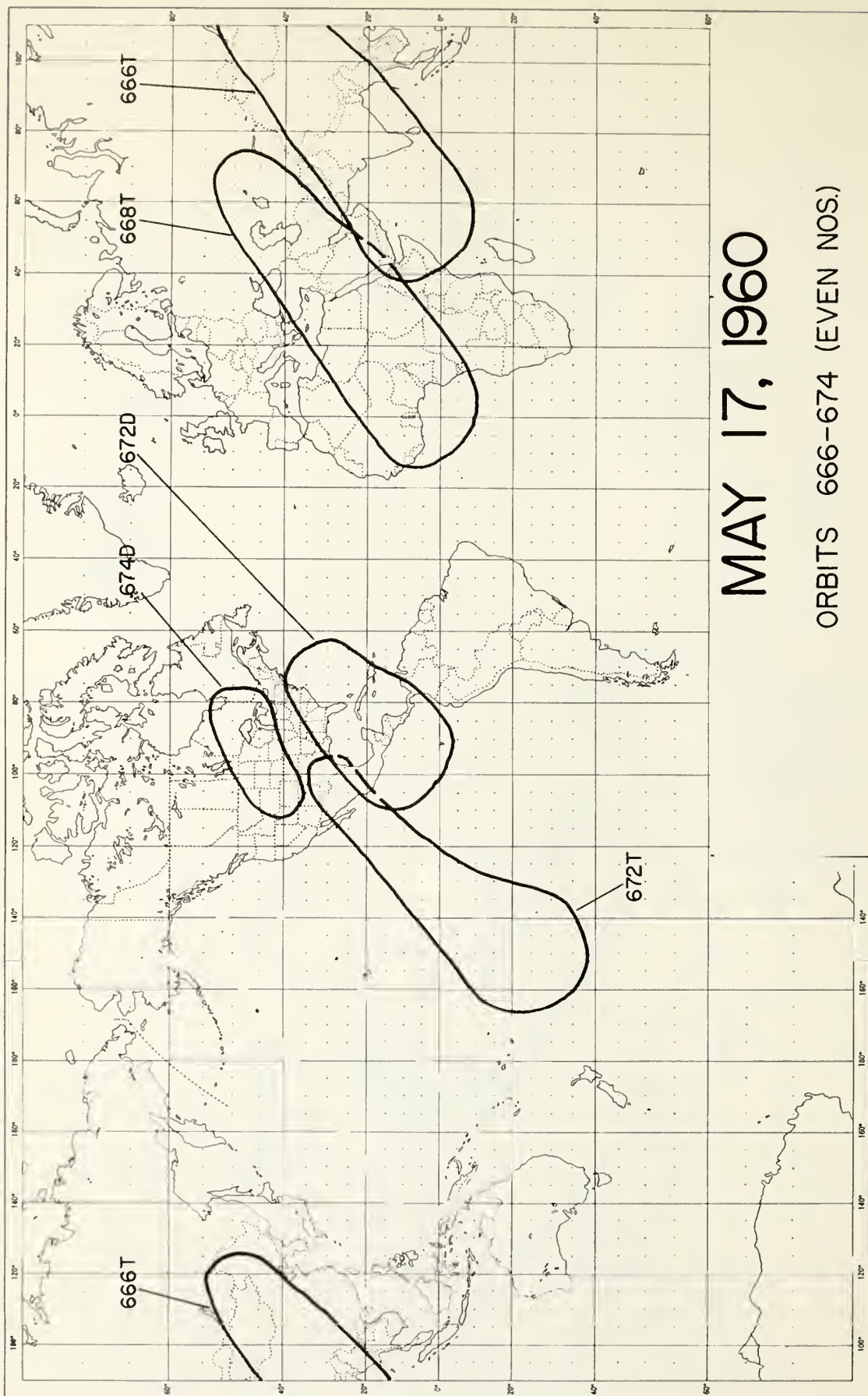
ORBITS 647-659 (ODD NOS.)





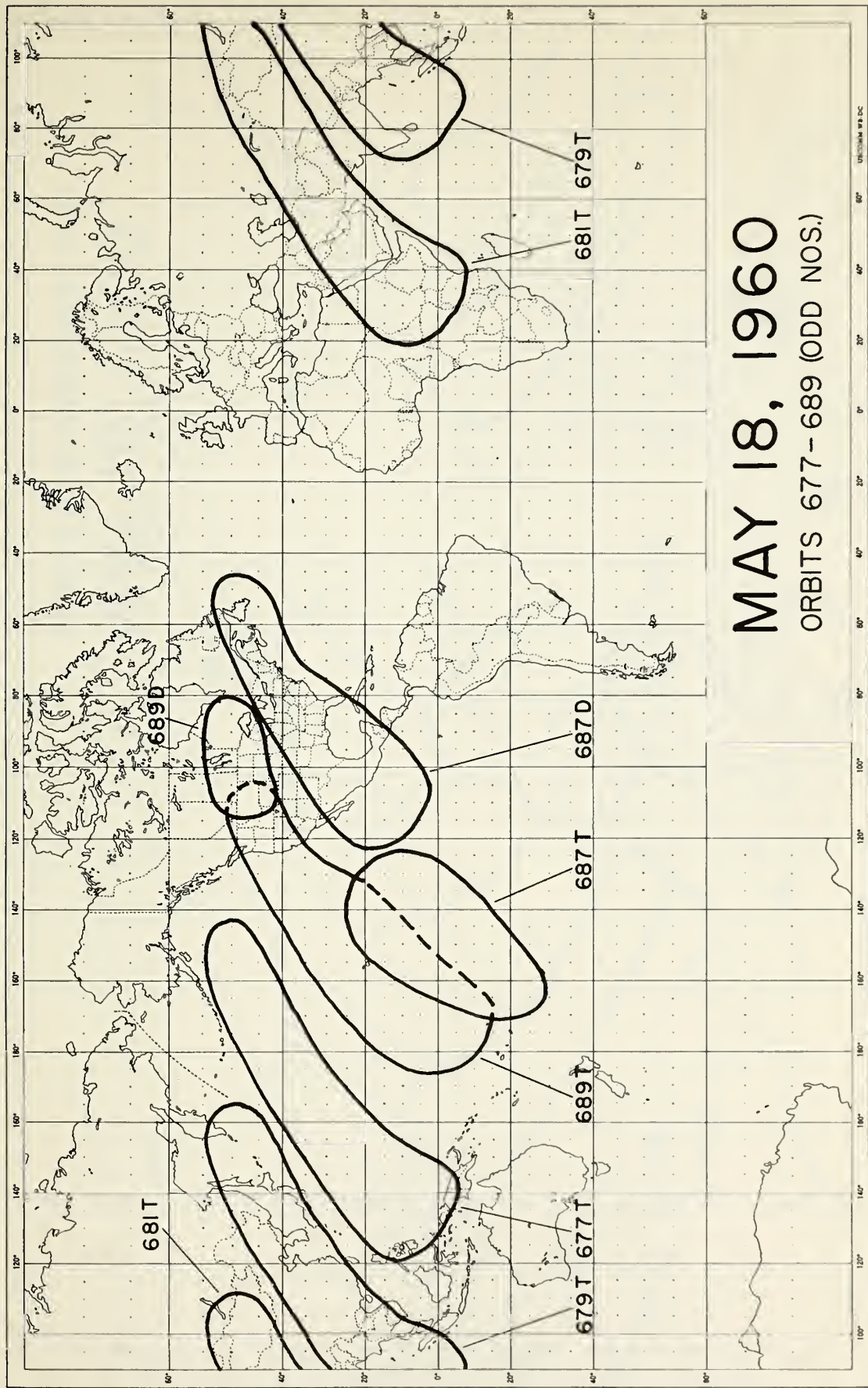
MAY 17, 1960

ORBITS 661-675 (ODD NOS.)

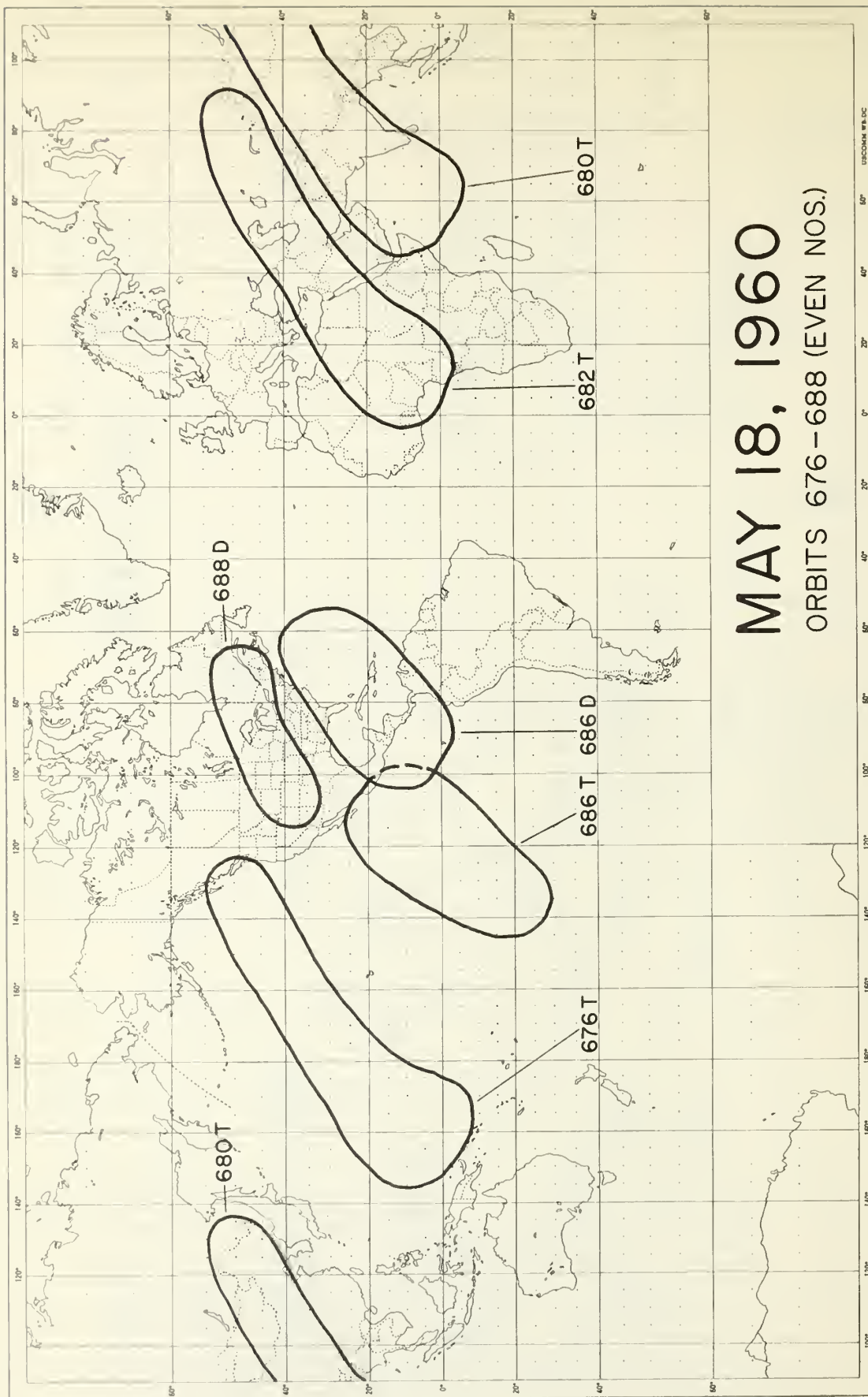


MAY 17, 1960

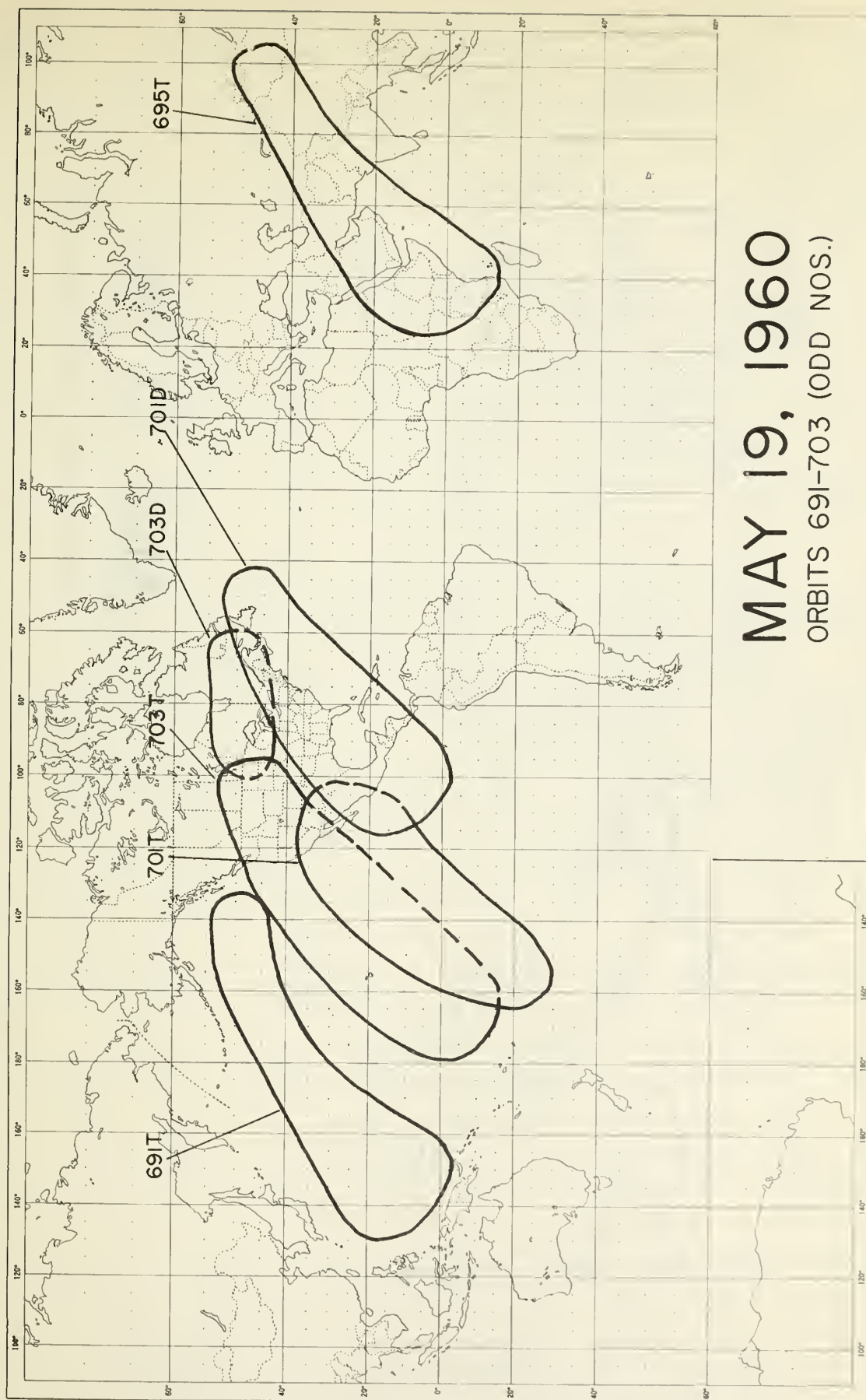
ORBITS 666-674 (EVEN NOS.)



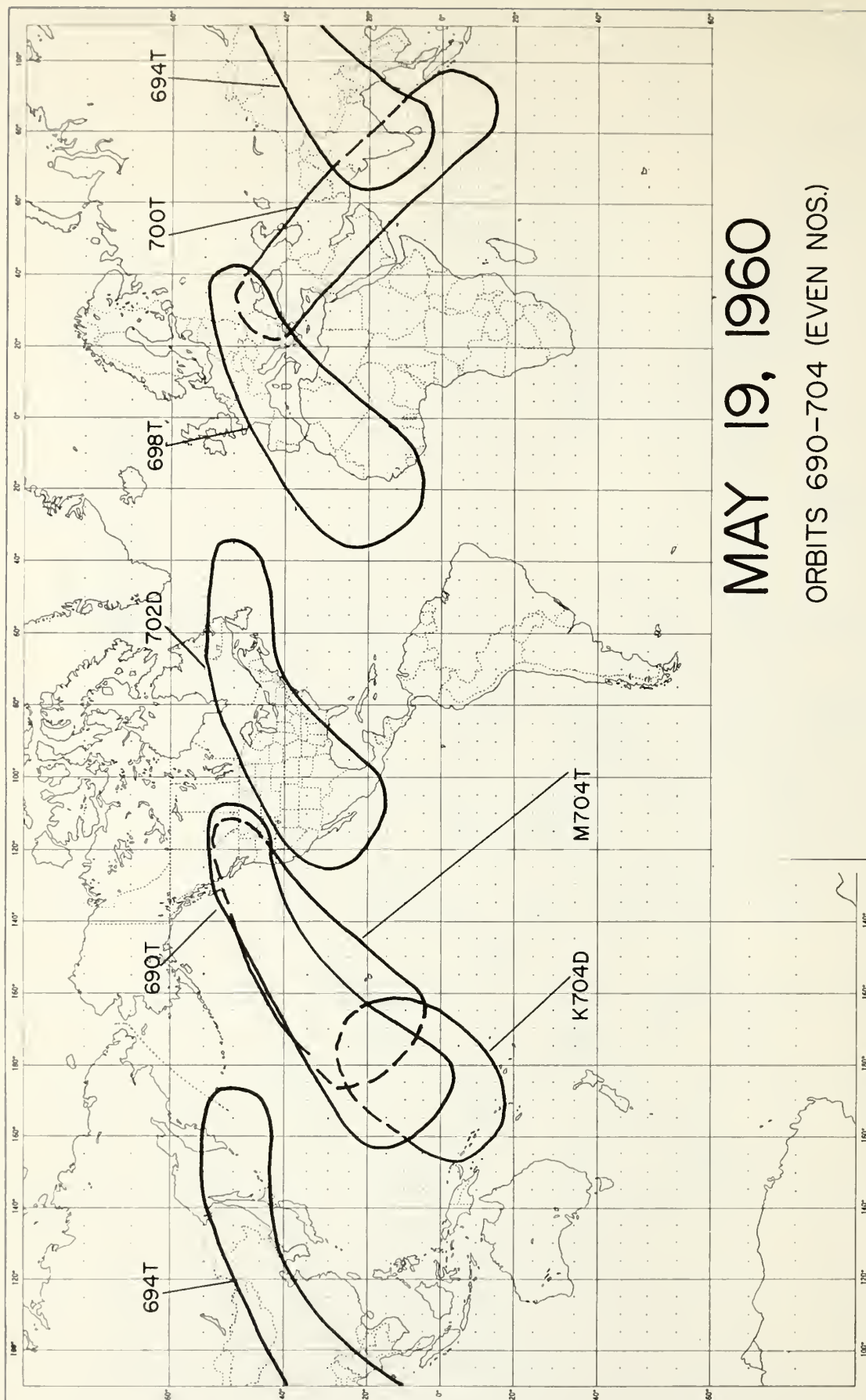
MAY 18, 1960
ORBITS 677-689 (ODD NOS.)



MAY 18, 1960
 ORBITS 676-688 (EVEN NOS.)

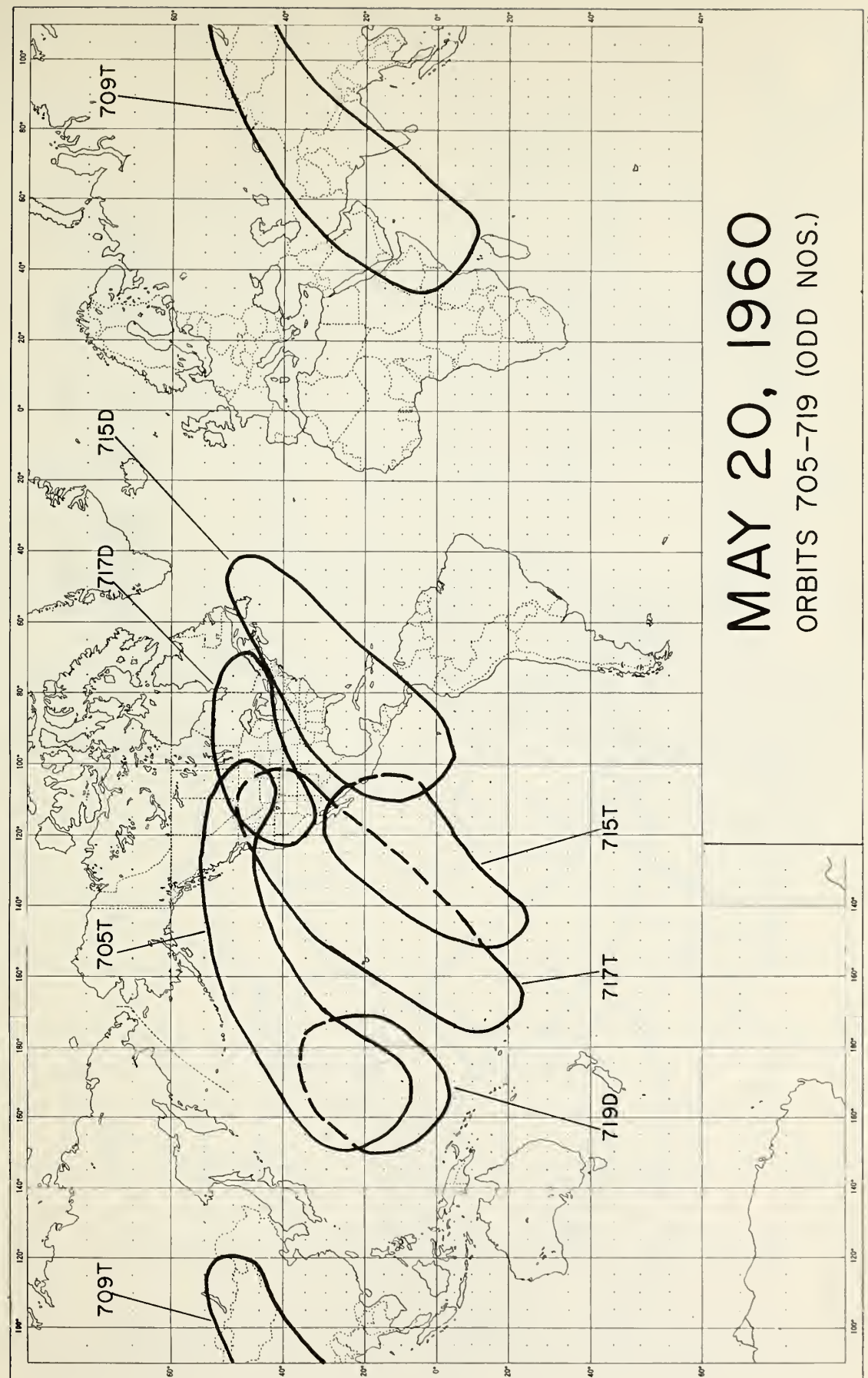


MAY 19, 1960
ORBITS 691-703 (ODD NOS.)

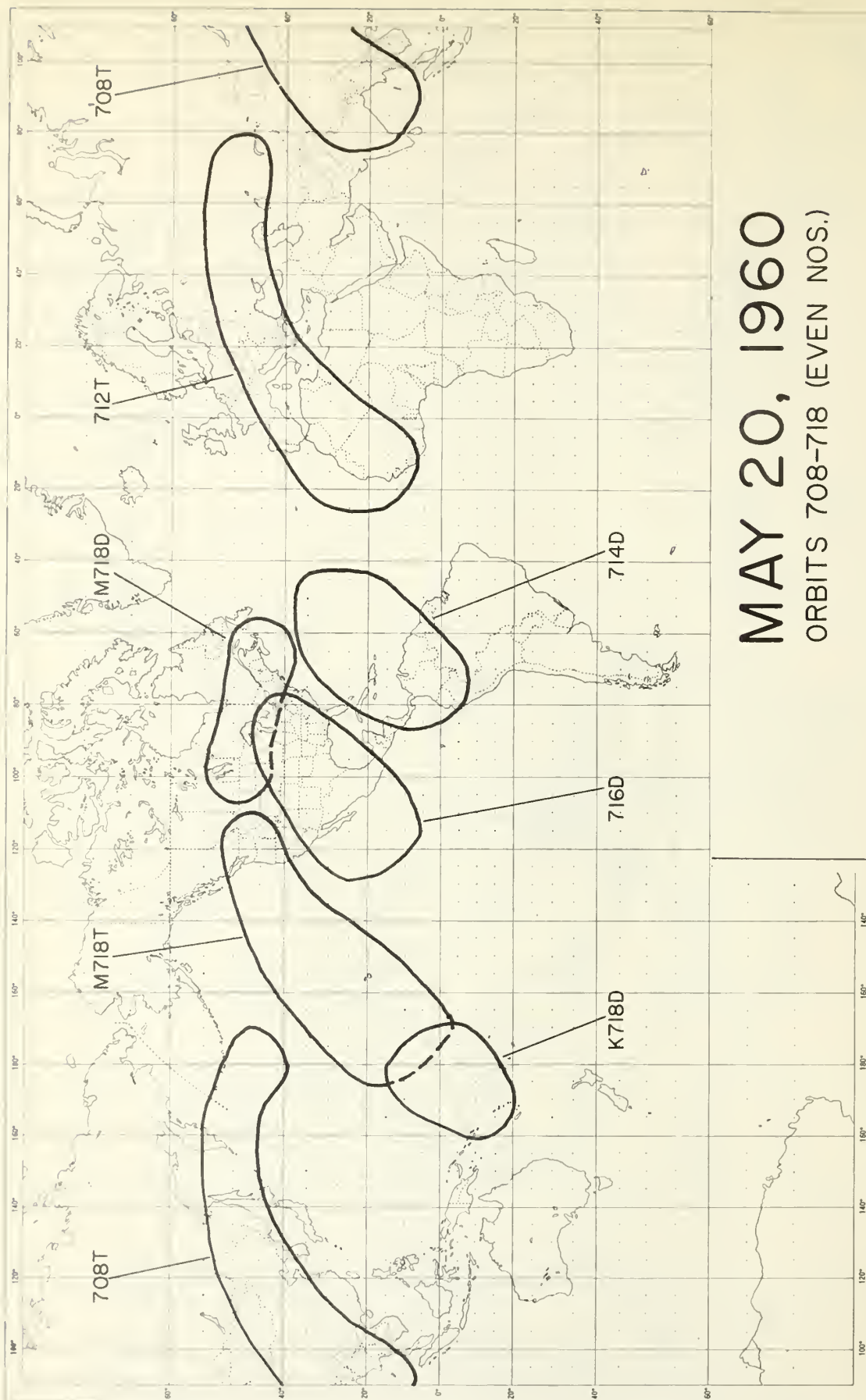


MAY 19, 1960

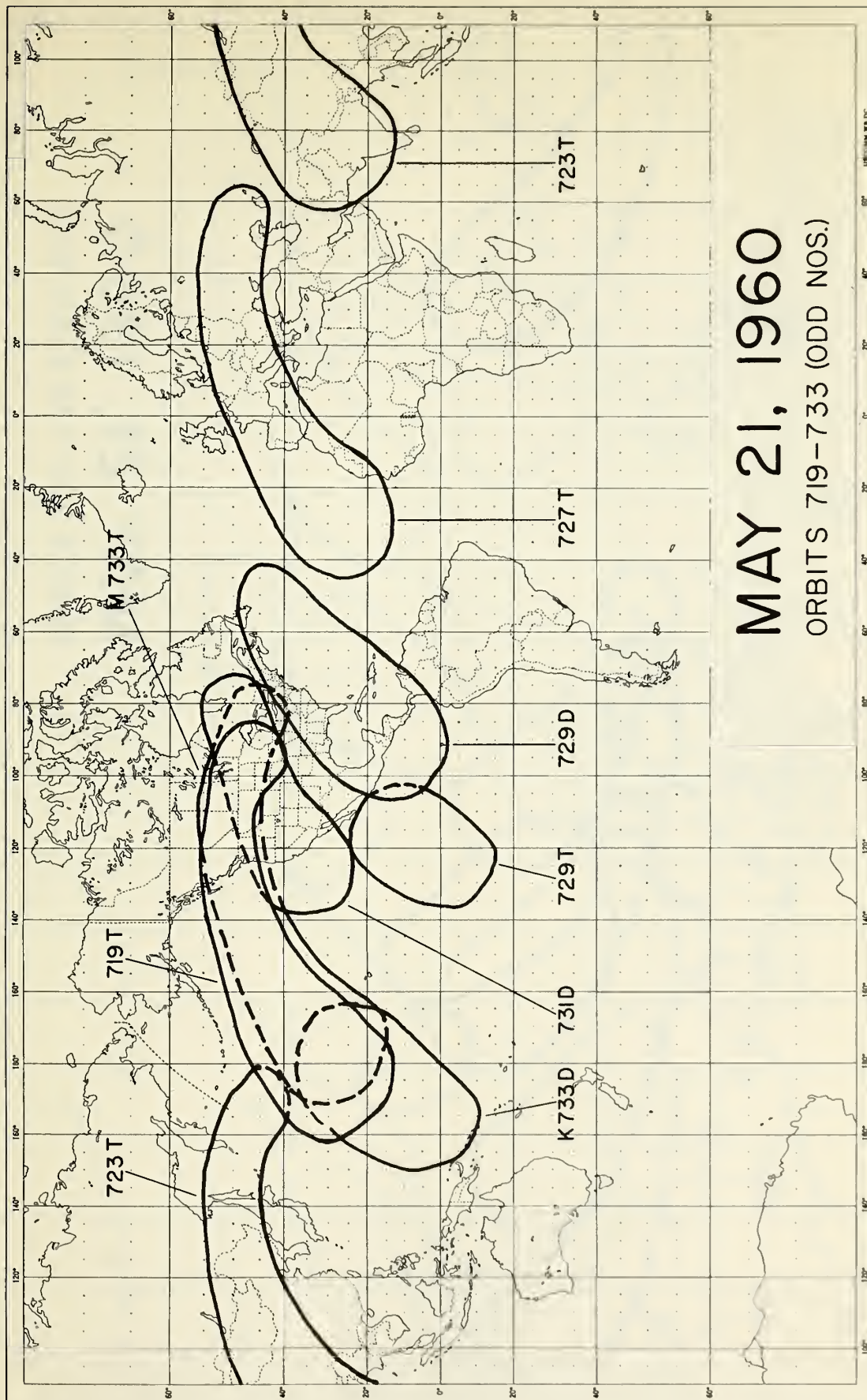
ORBITS 690-704 (EVEN NOS.)



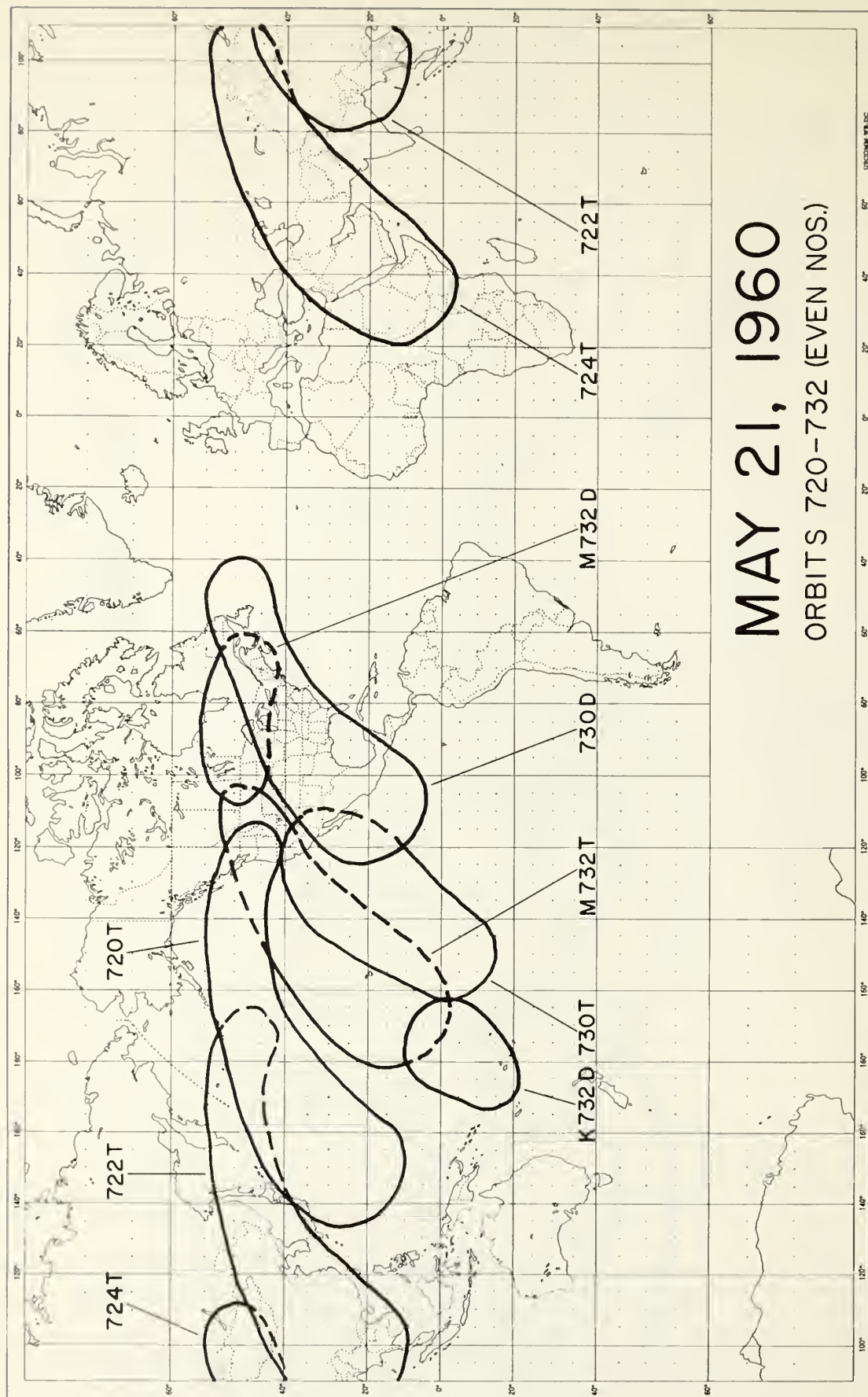
MAY 20, 1960
 ORBITS 705-719 (ODD NOS.)

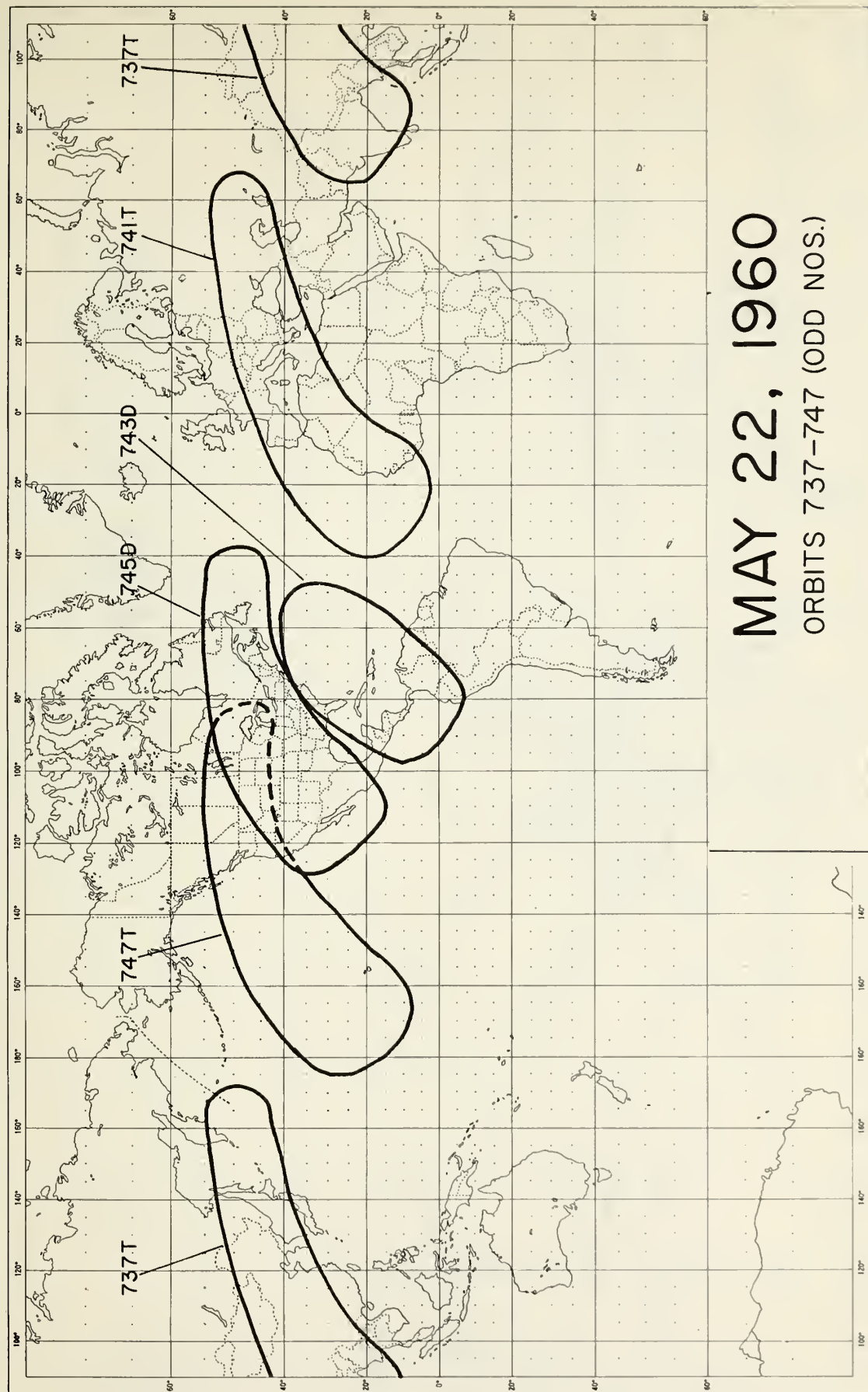


MAY 20, 1960
ORBITS 708-718 (EVEN NOS.)



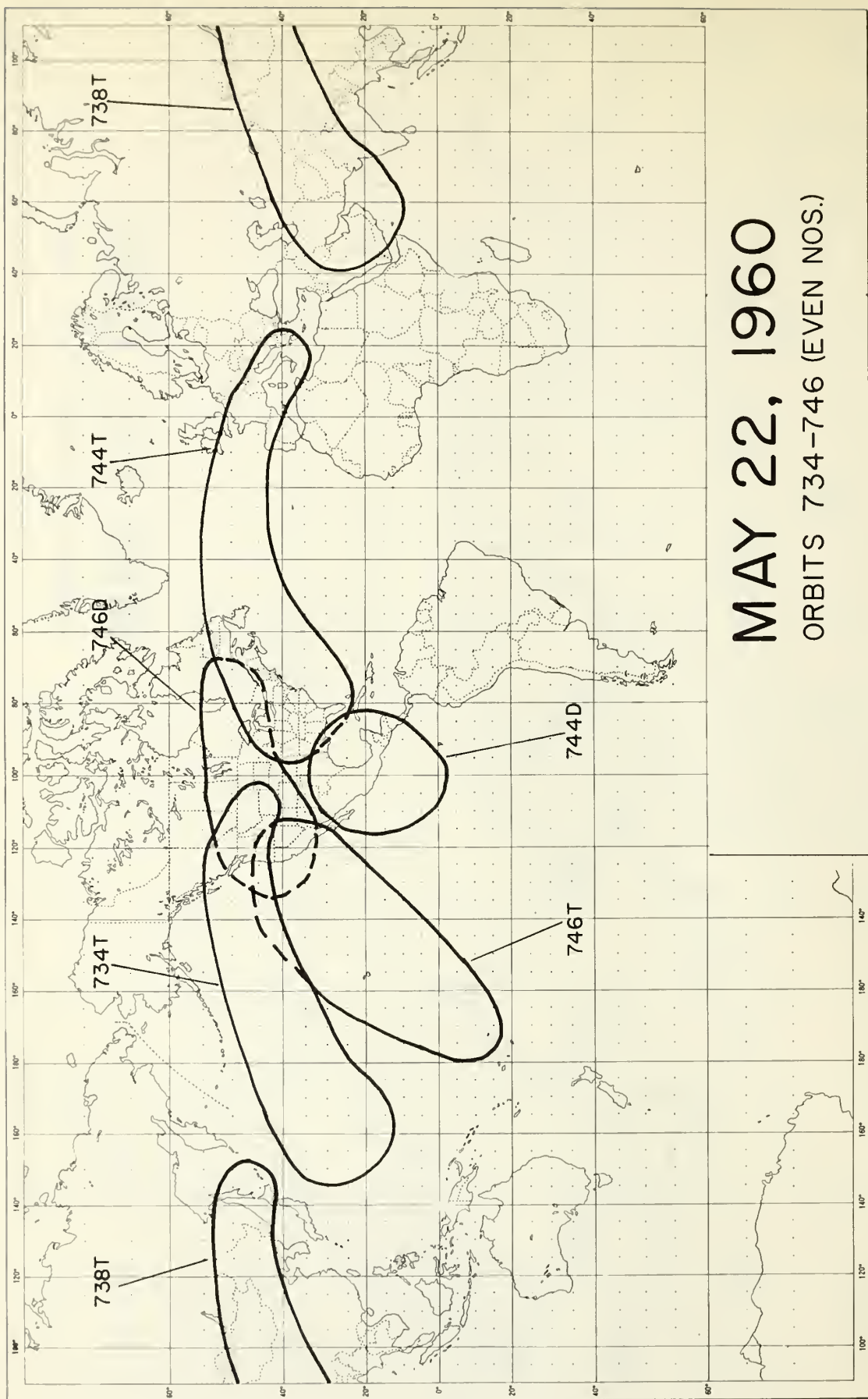
MAY 21, 1960
 ORBITS 719-733 (ODD NOS.)



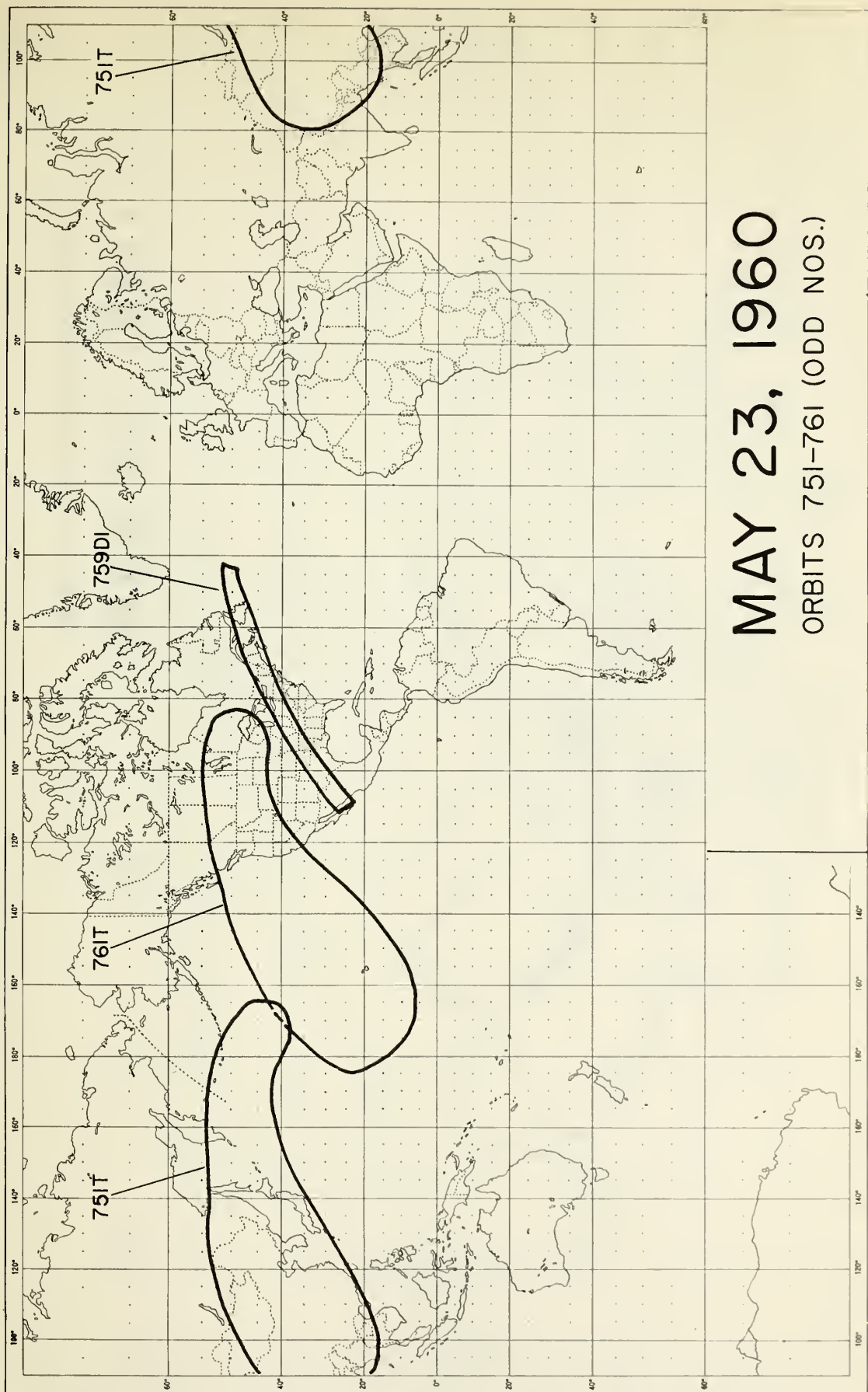


MAY 22, 1960

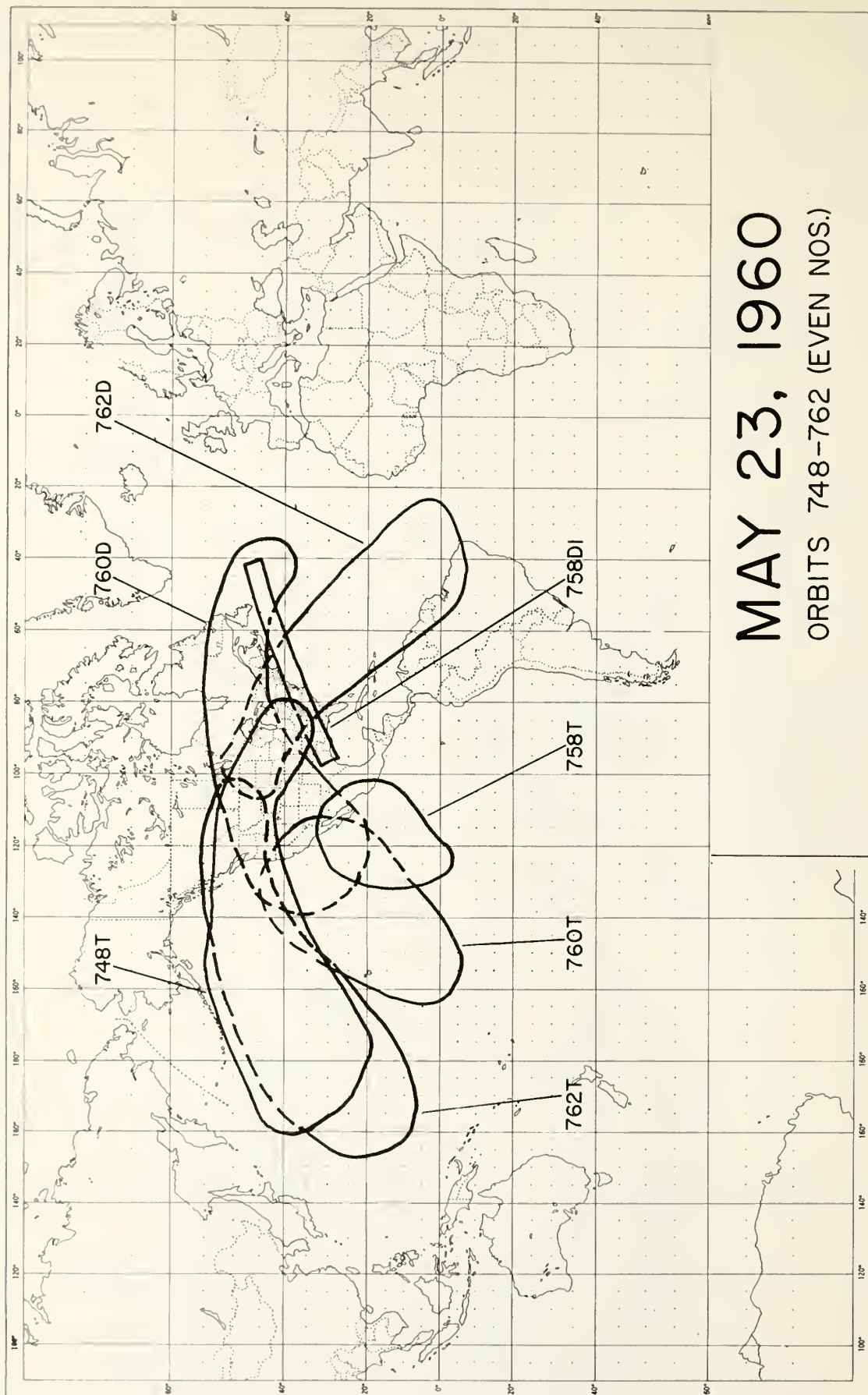
ORBITS 737-747 (ODD NOS.)



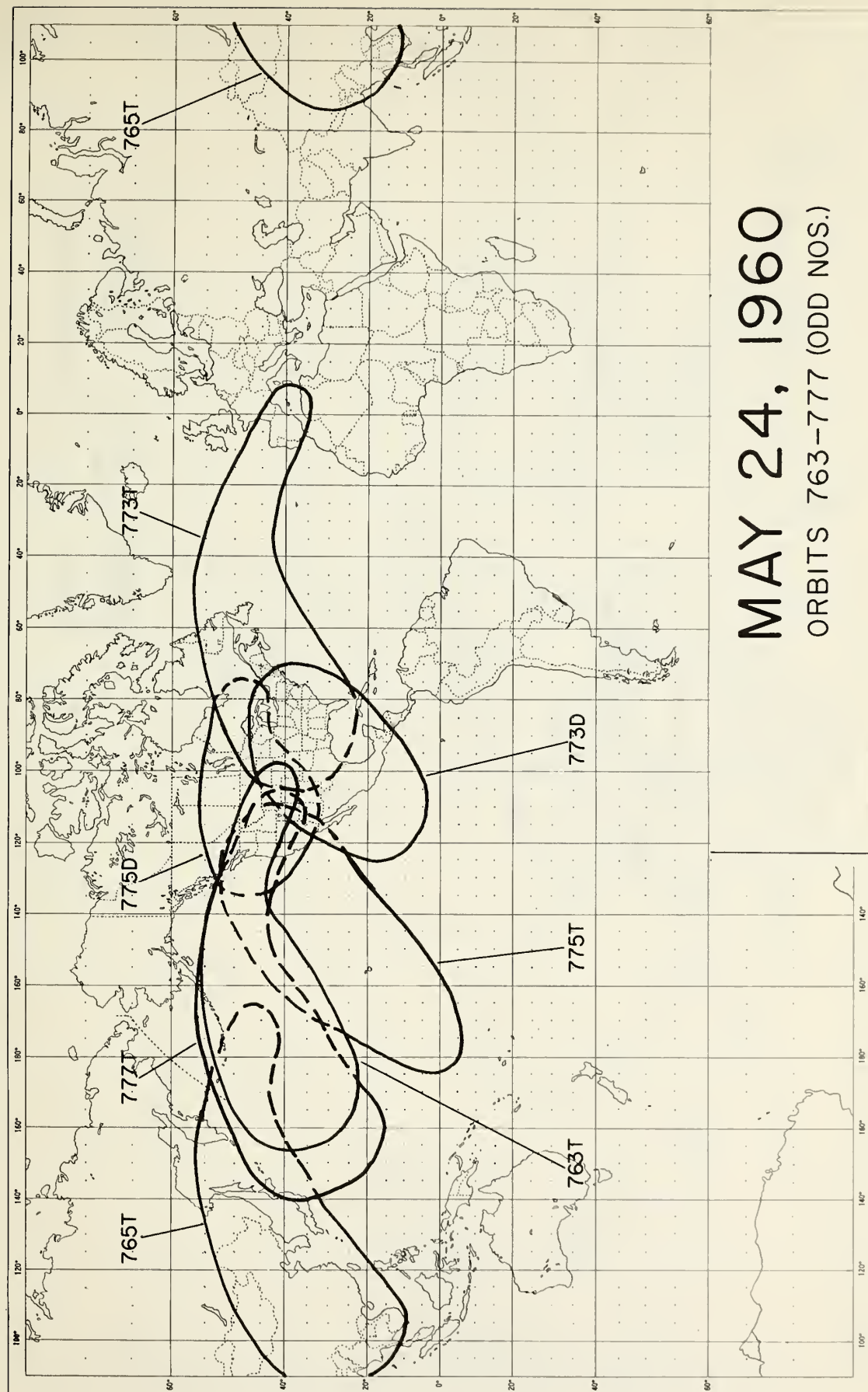
MAY 22, 1960
 ORBITS 734-746 (EVEN NOS.)



MAY 23, 1960
ORBITS 75I-76I (ODD NOS.)



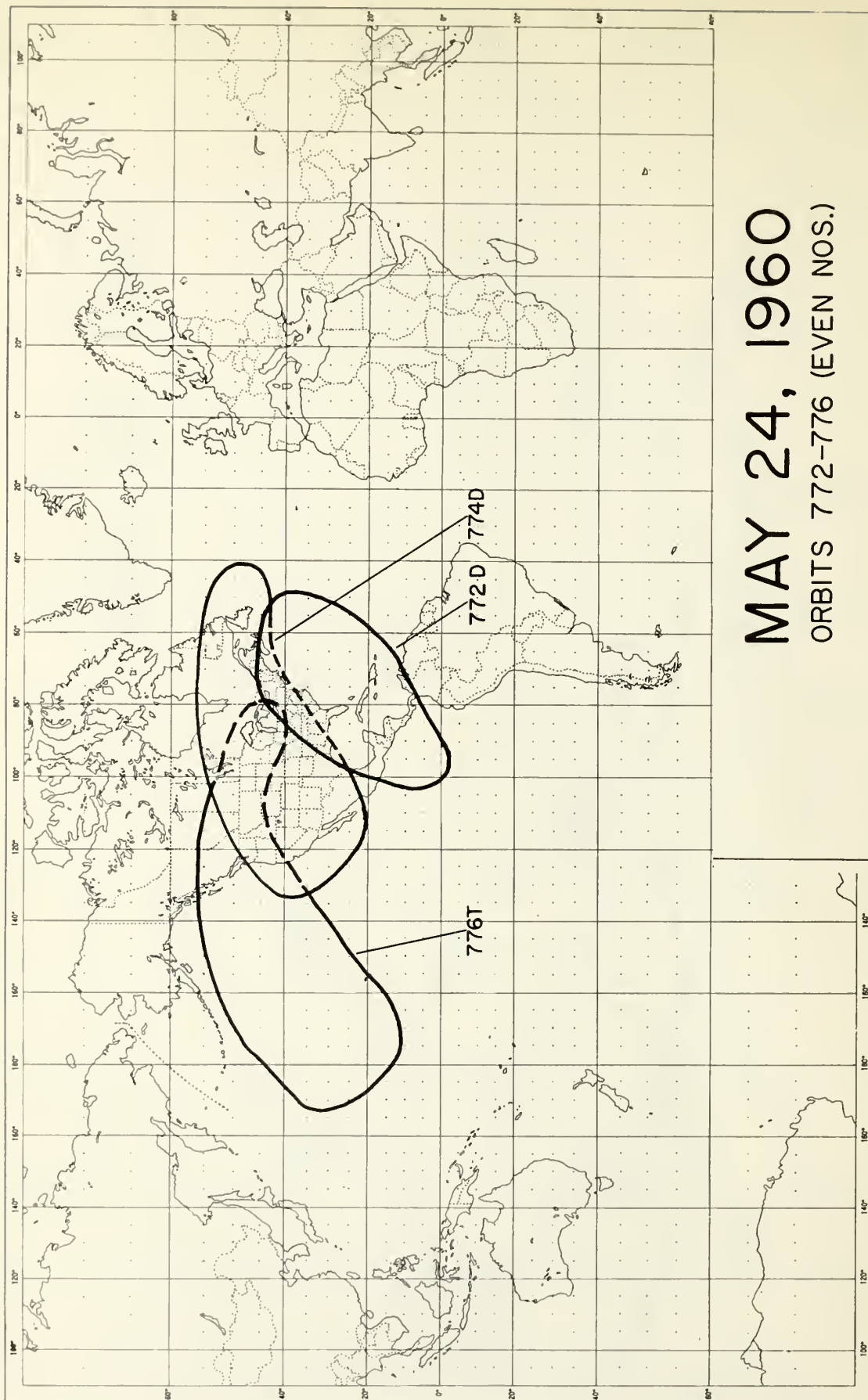
MAY 23, 1960
 ORBITS 748-762 (EVEN NOS.)



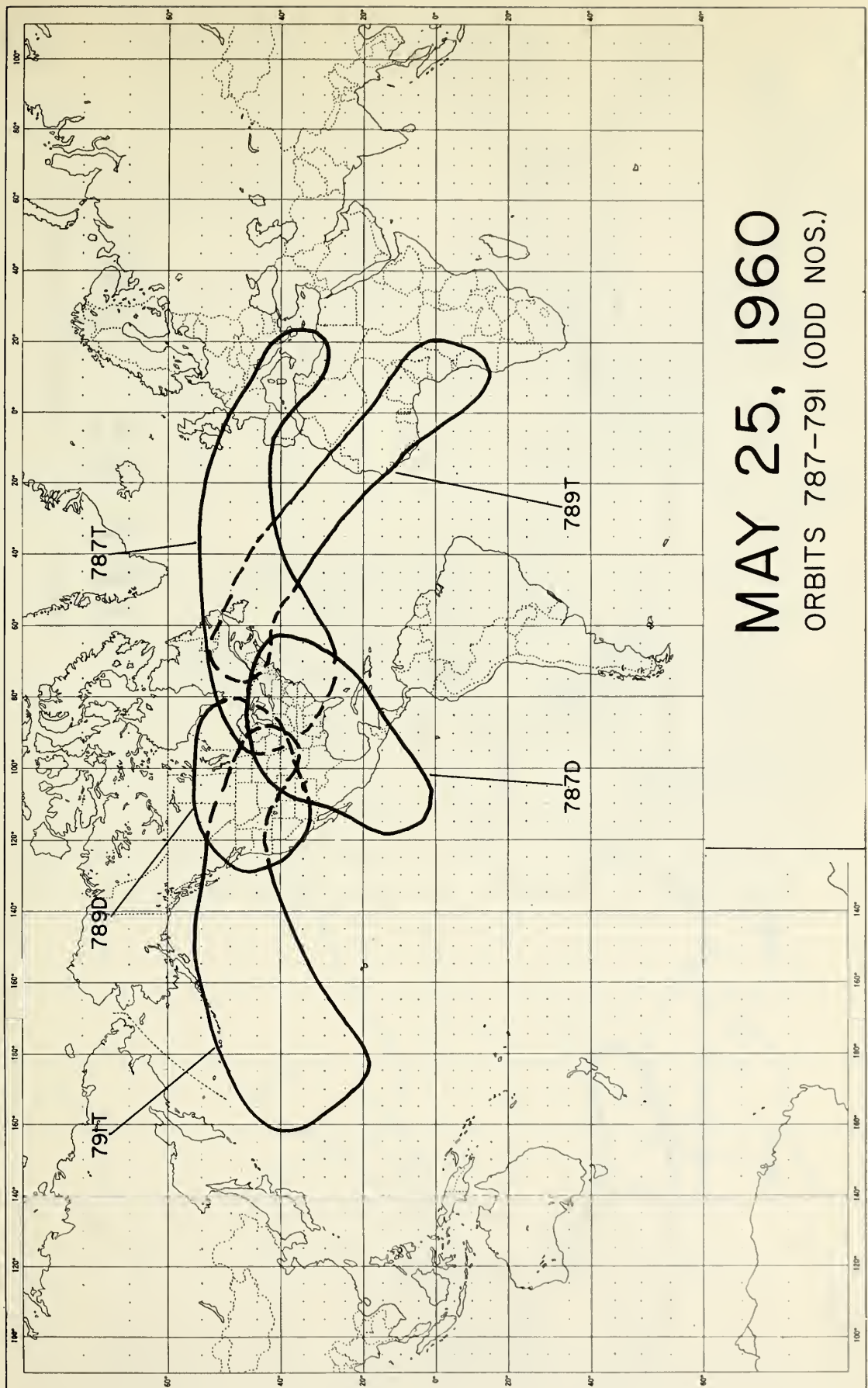
MAY 24, 1960

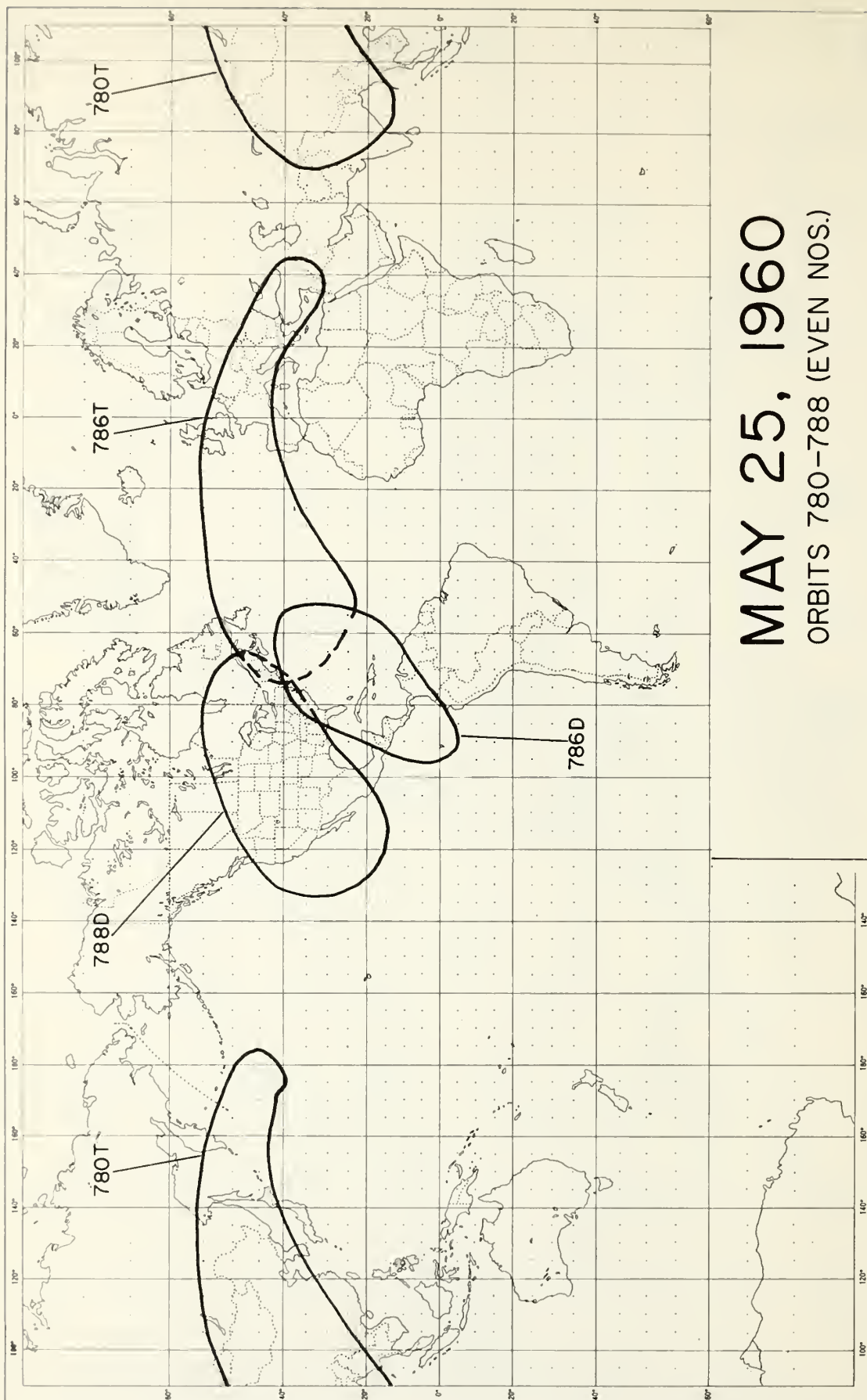
ORBITS 763-777 (ODD NOS.)

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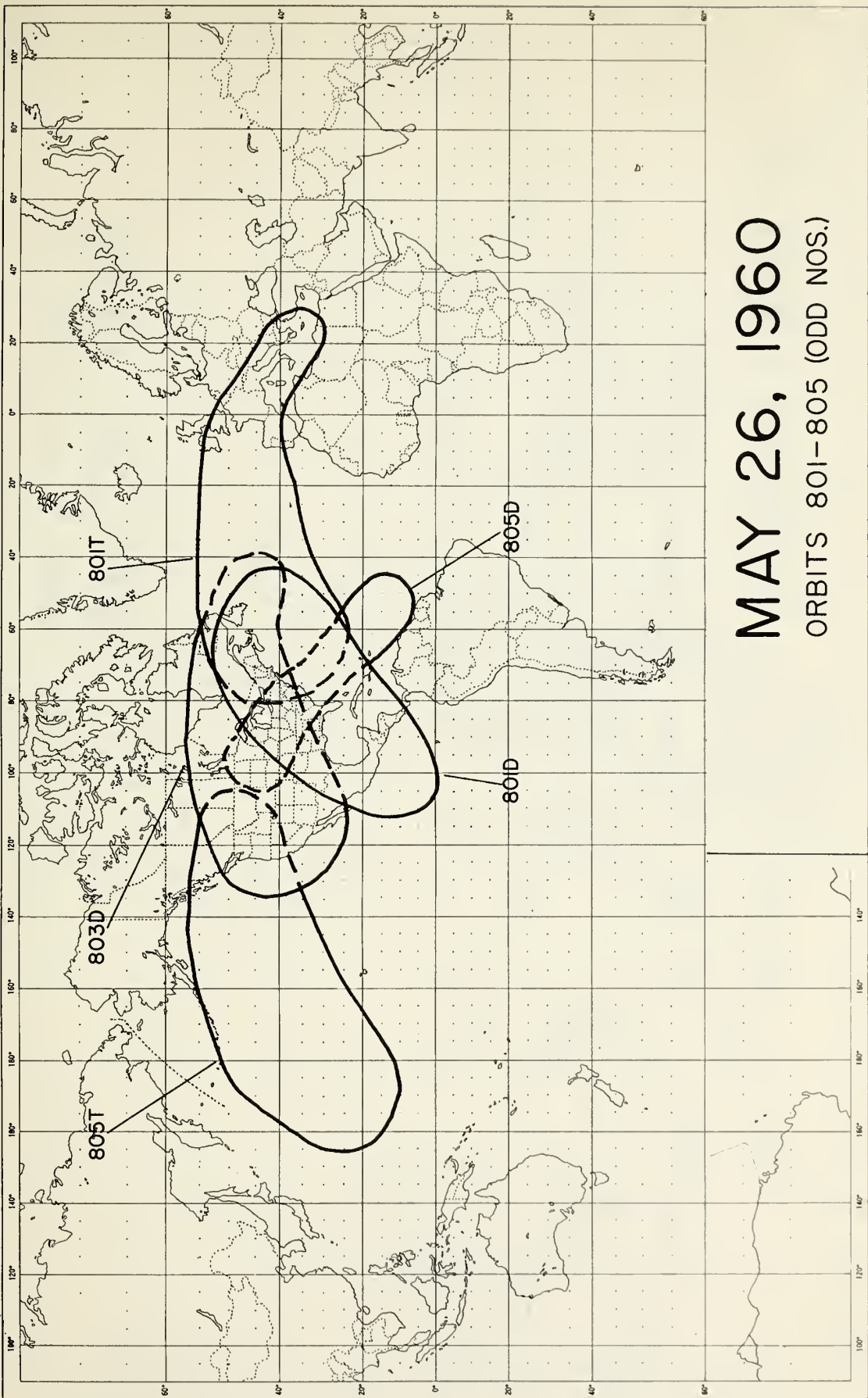


MAY 24, 1960
ORBITS 772-776 (EVEN NOS.)



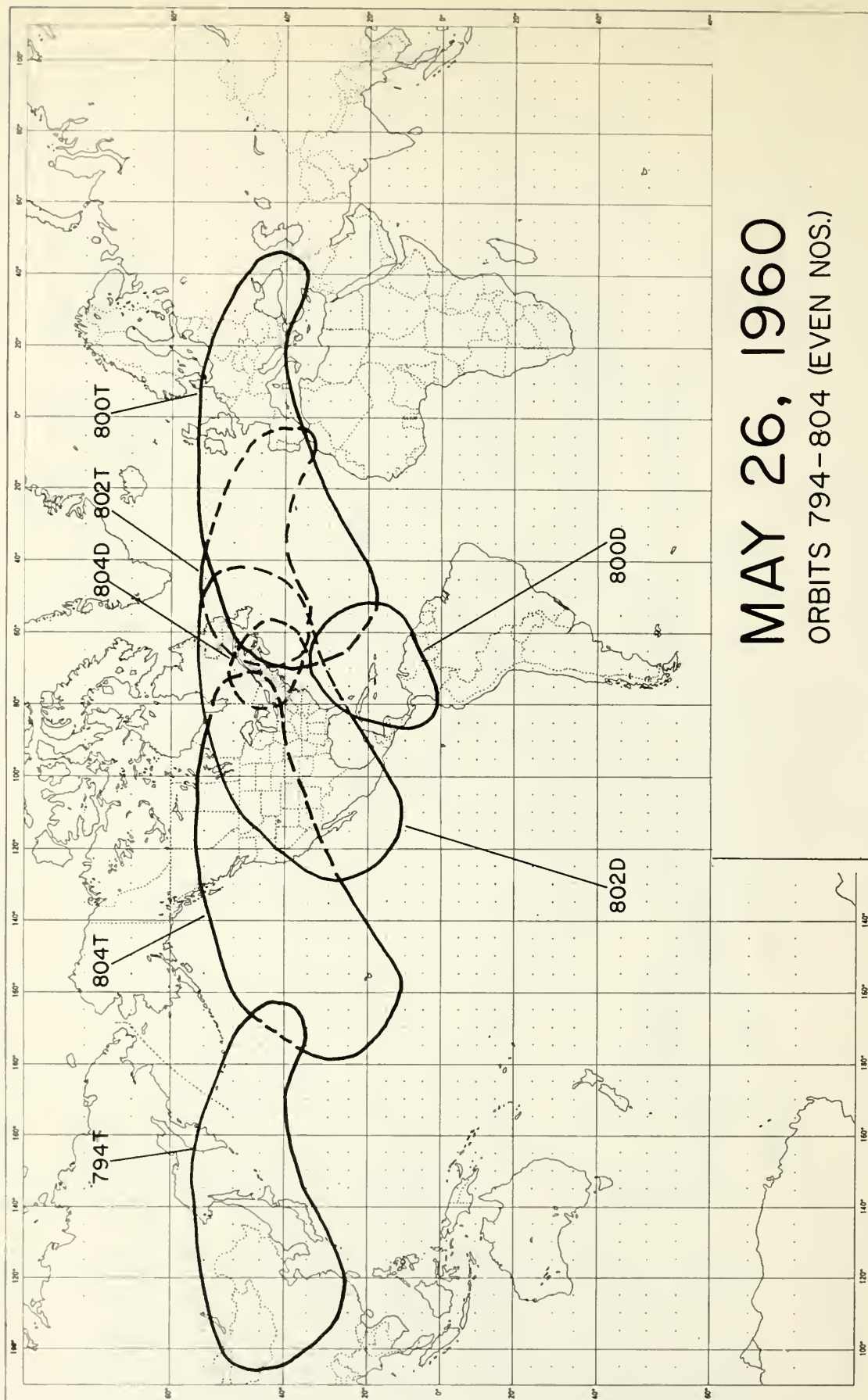


MAY 25, 1960
 ORBITS 780-788 (EVEN NOS.)

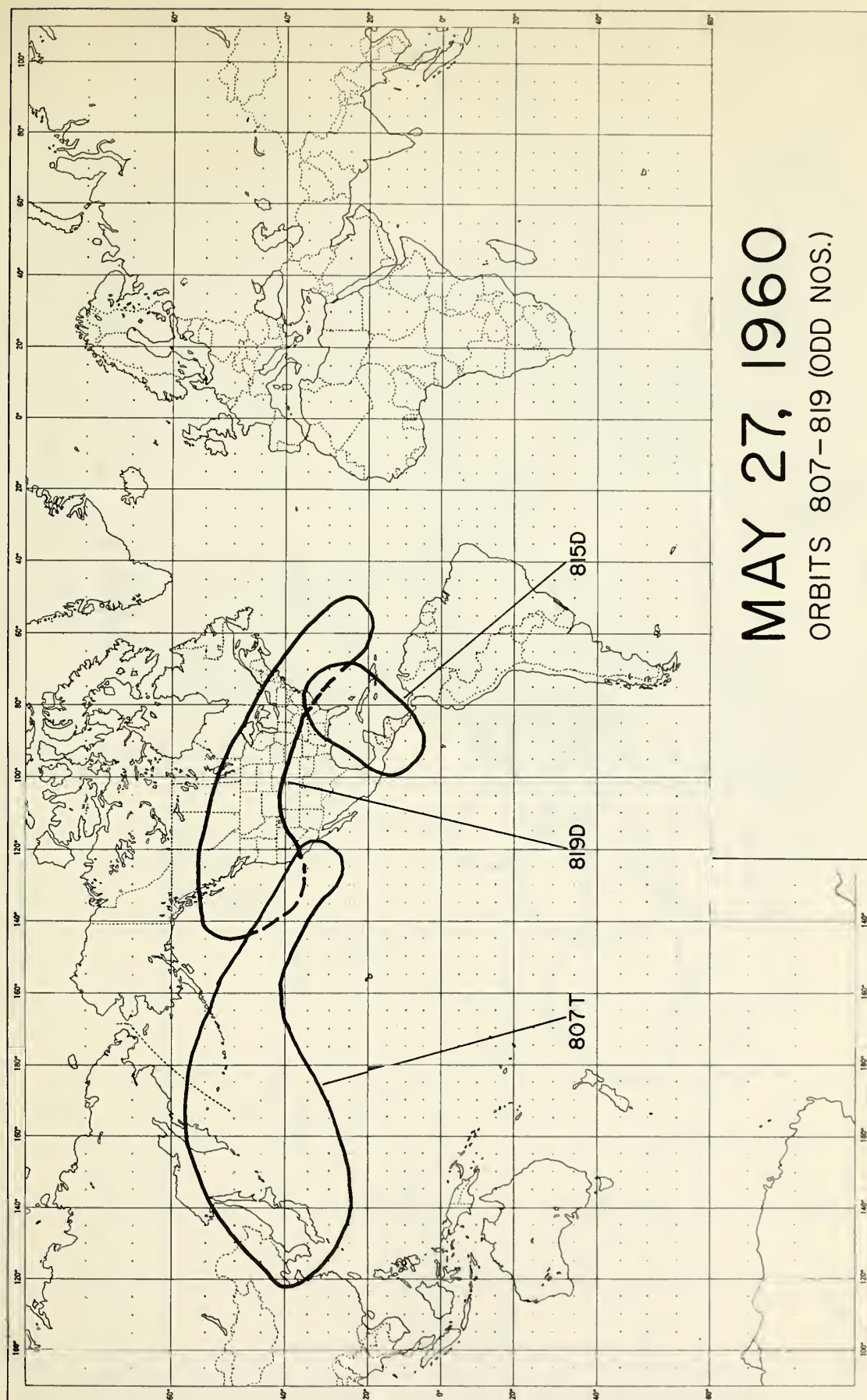


MAY 26, 1960

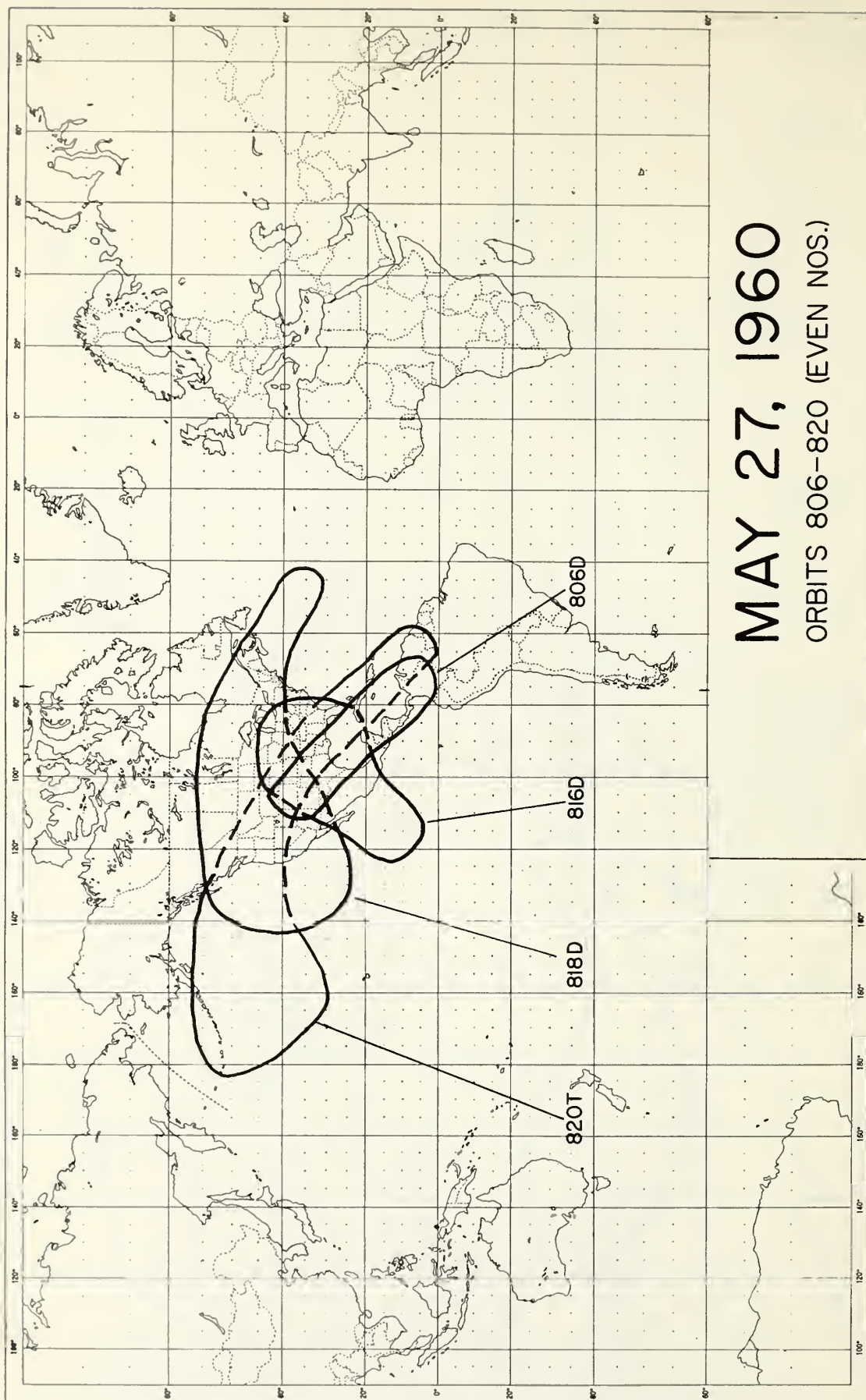
ORBITS 801-805 (ODD NOS.)



MAY 26, 1960
ORBITS 794-804 (EVEN NOS.)

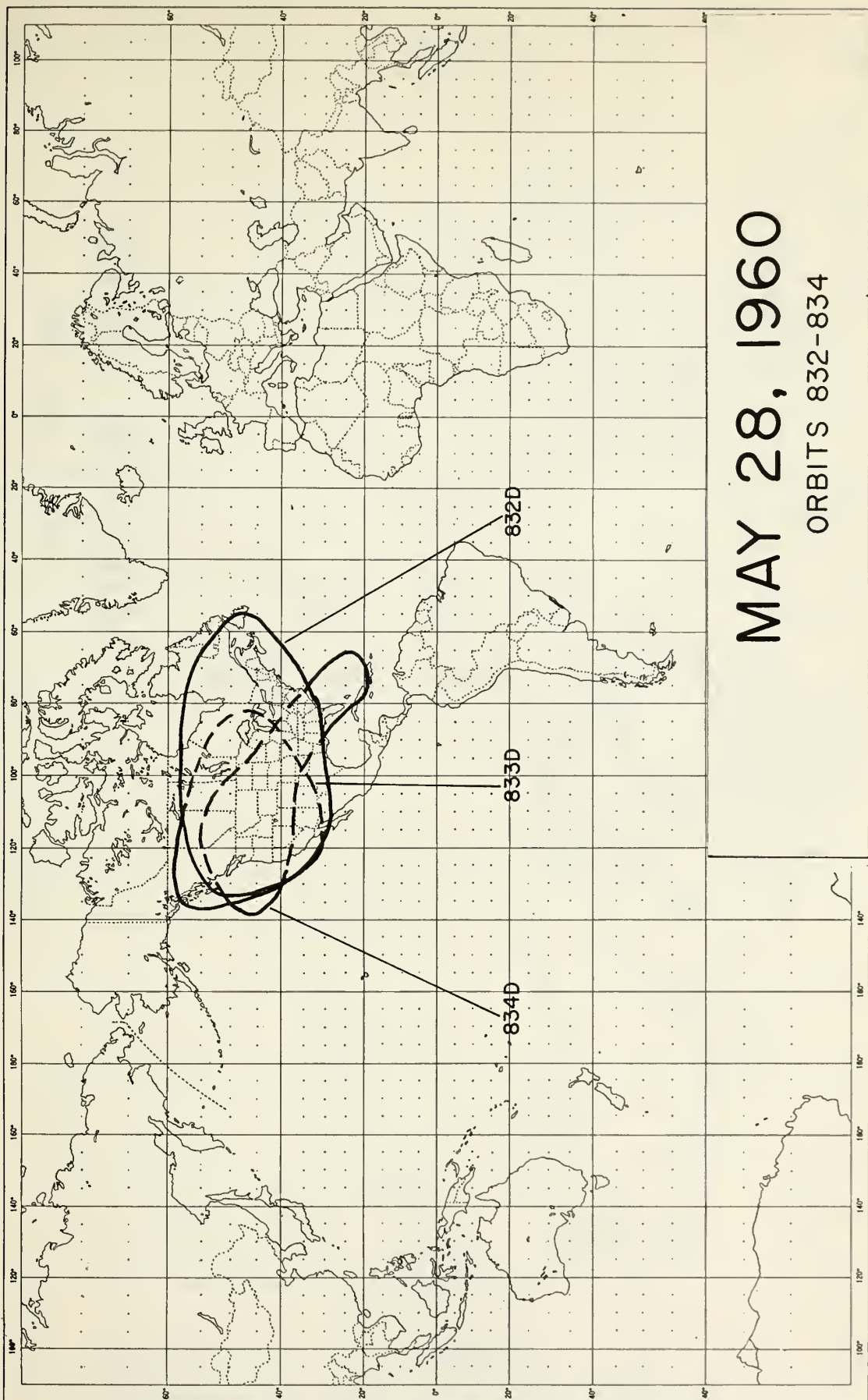


MAY 27, 1960
ORBITS 807-819 (ODD NOS.)



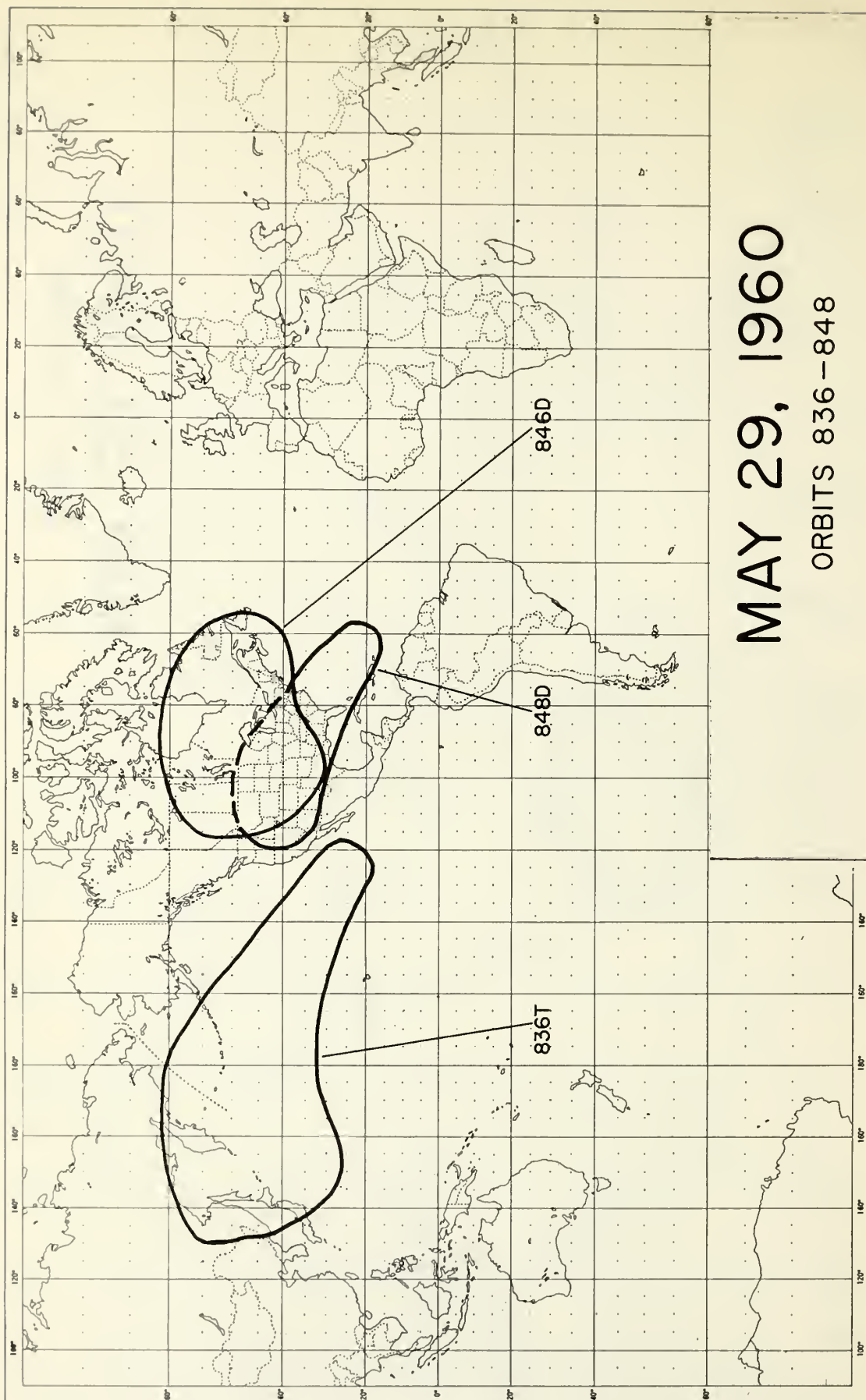
MAY 27, 1960

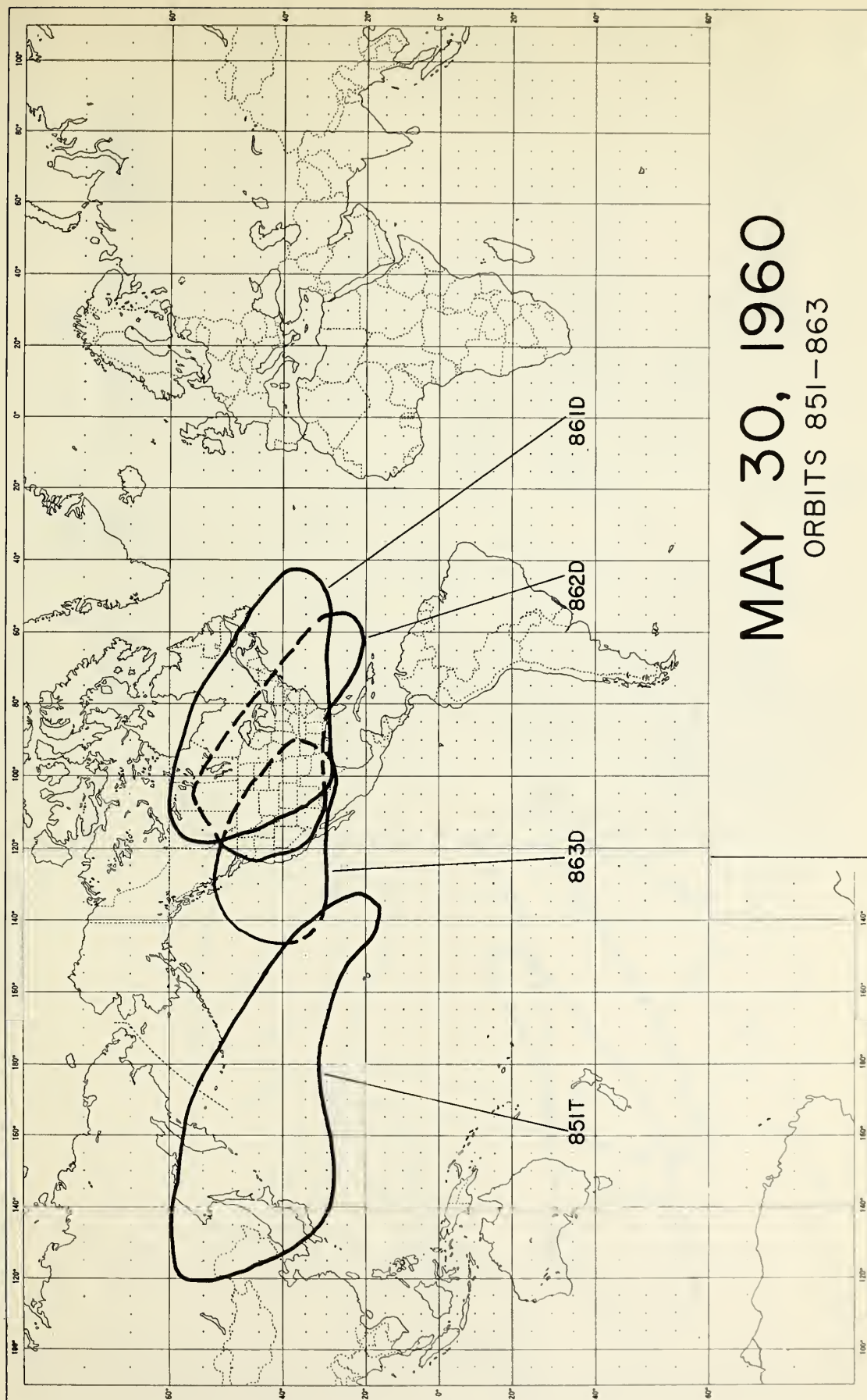
ORBITS 806-820 (EVEN NOS.)



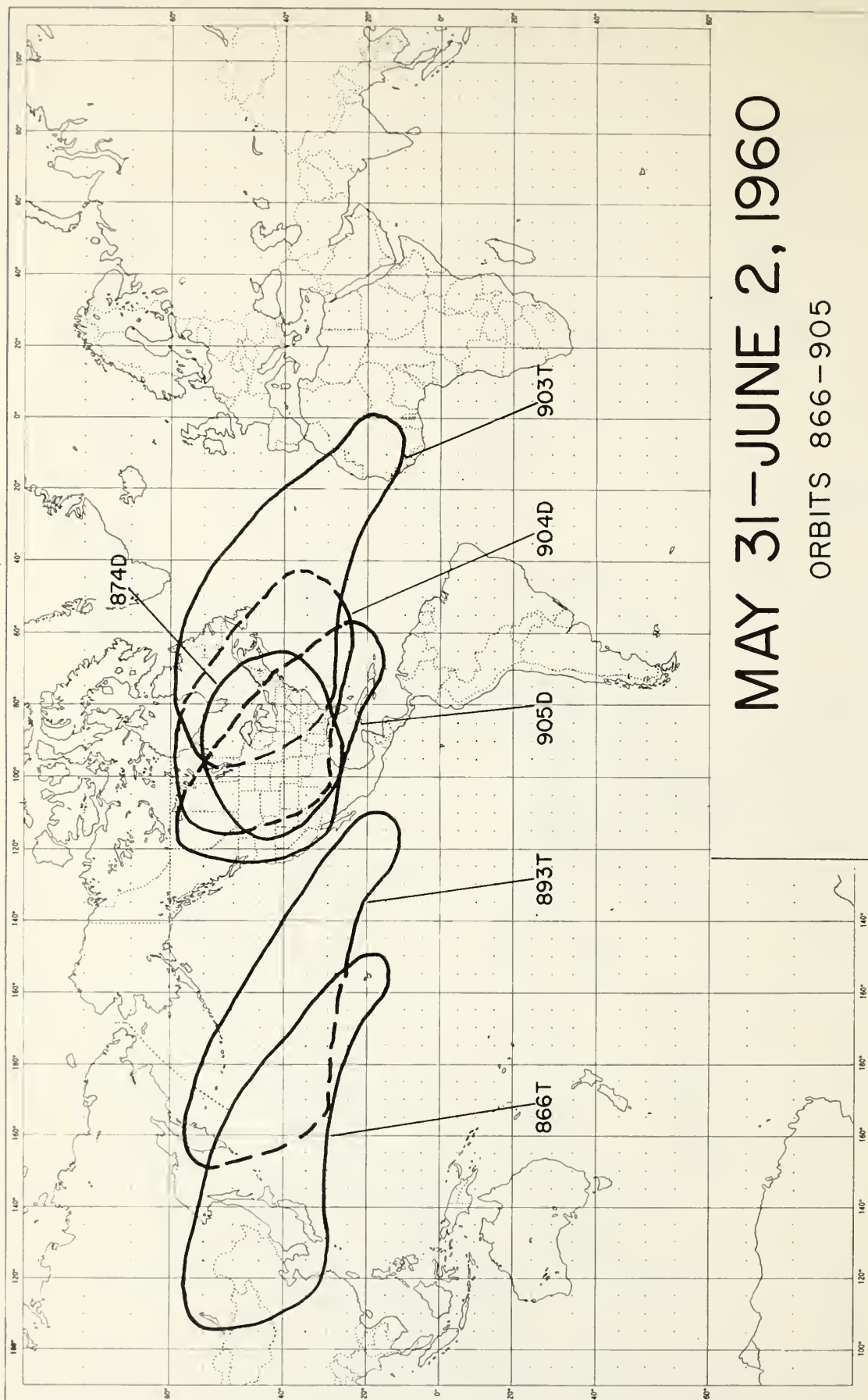
MAY 28, 1960

ORBITS 832-834





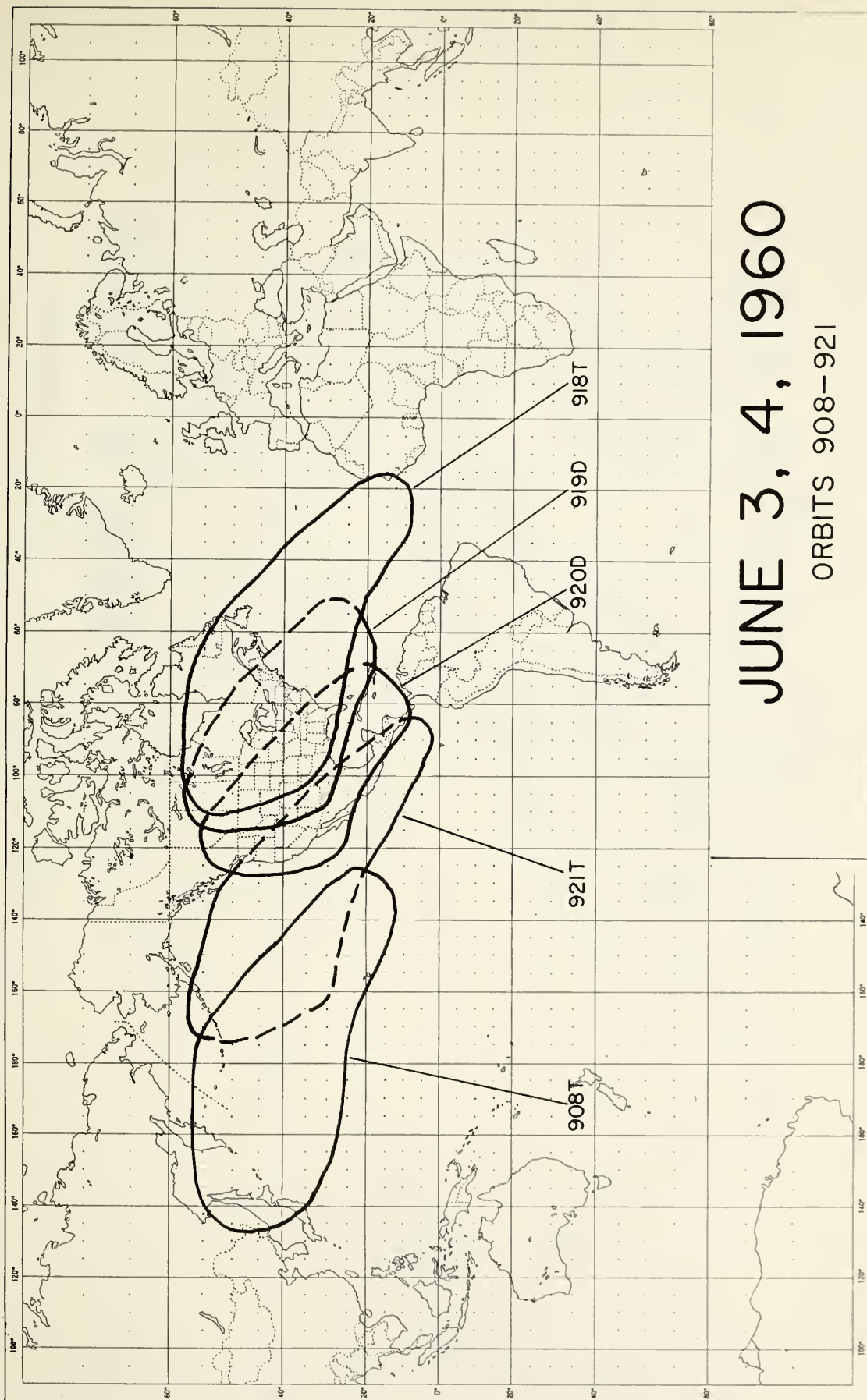
MAY 30, 1960
ORBITS 851-863

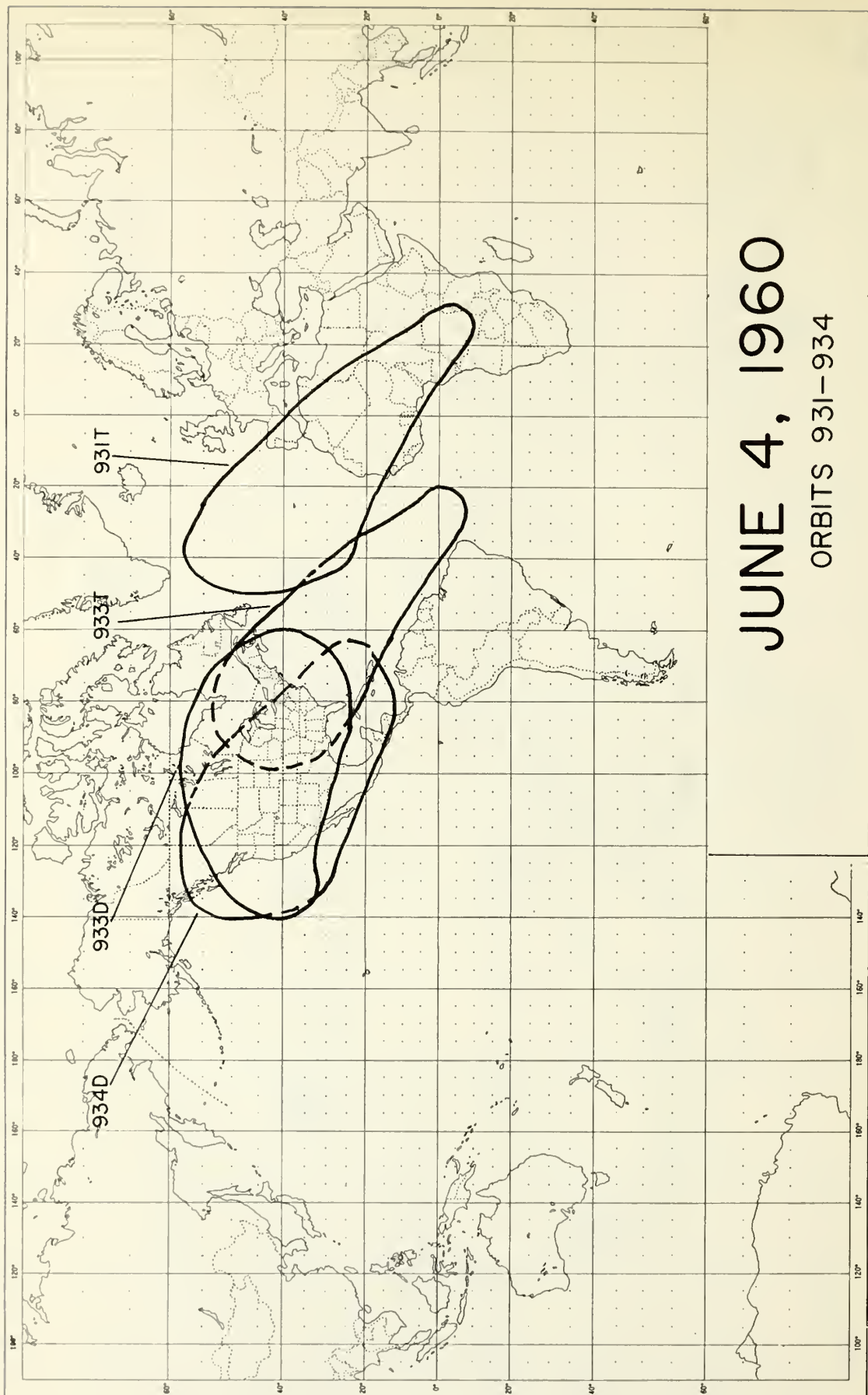


MAY 31-JUNE 2, 1960

ORBITS 866-905

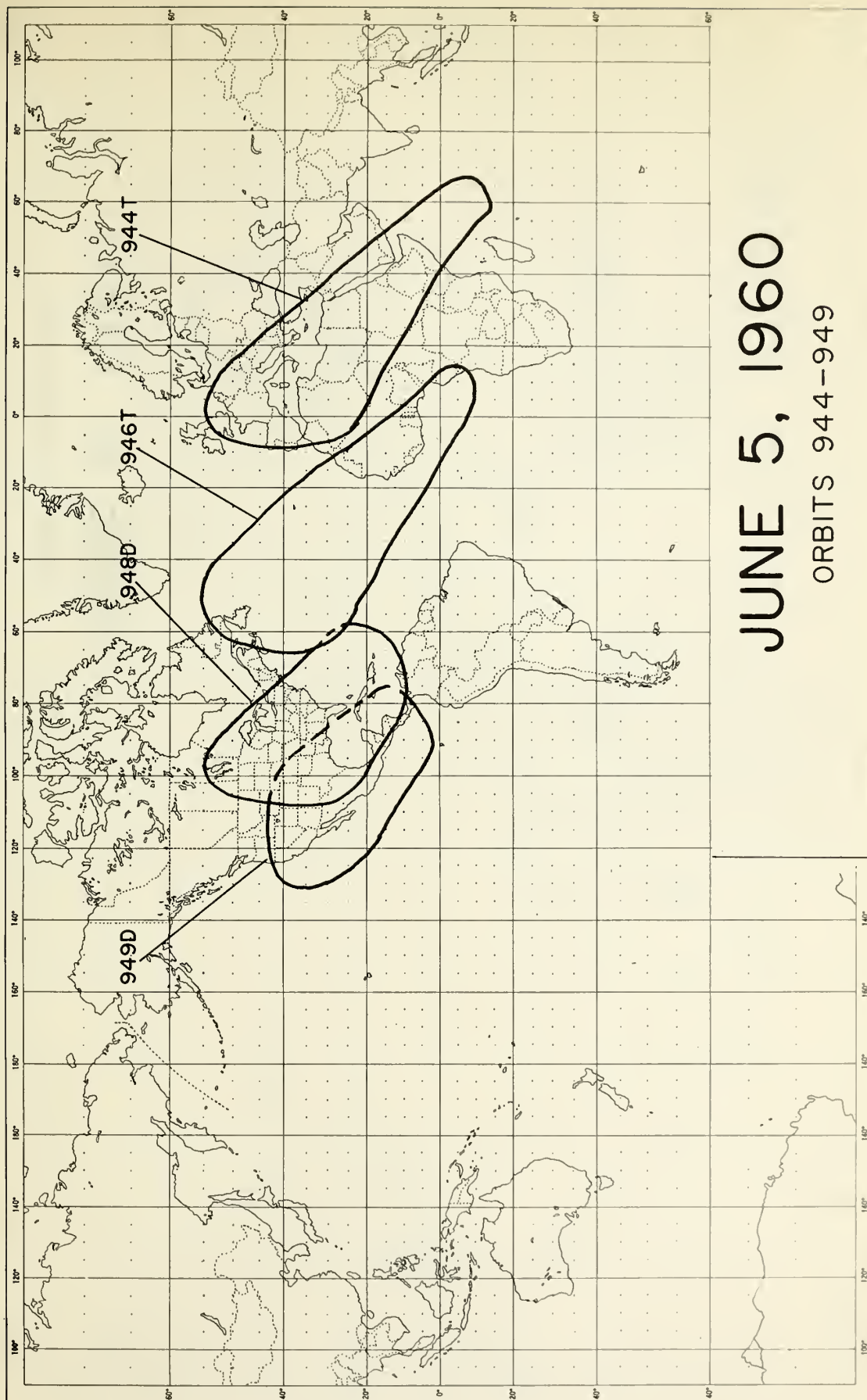
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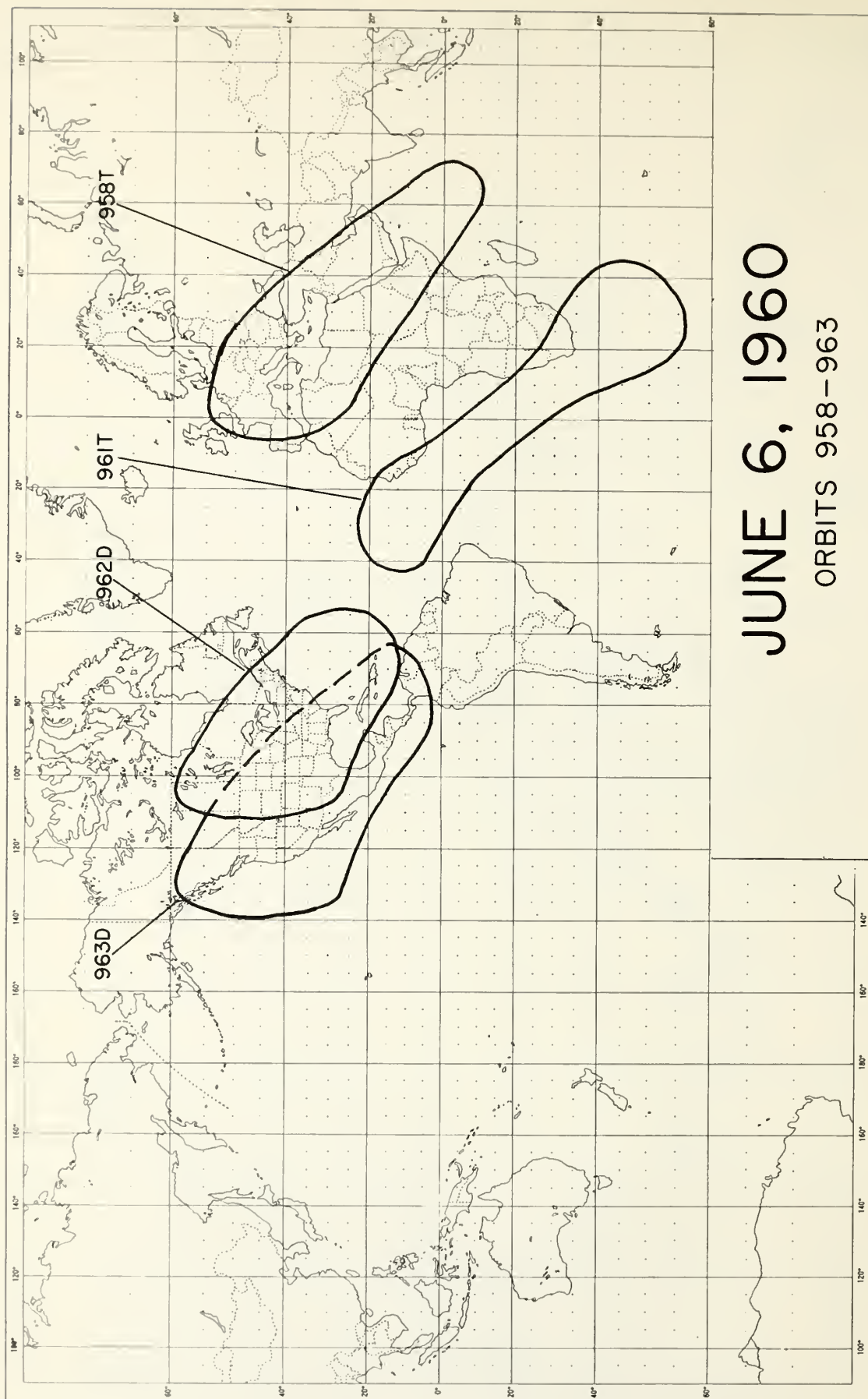


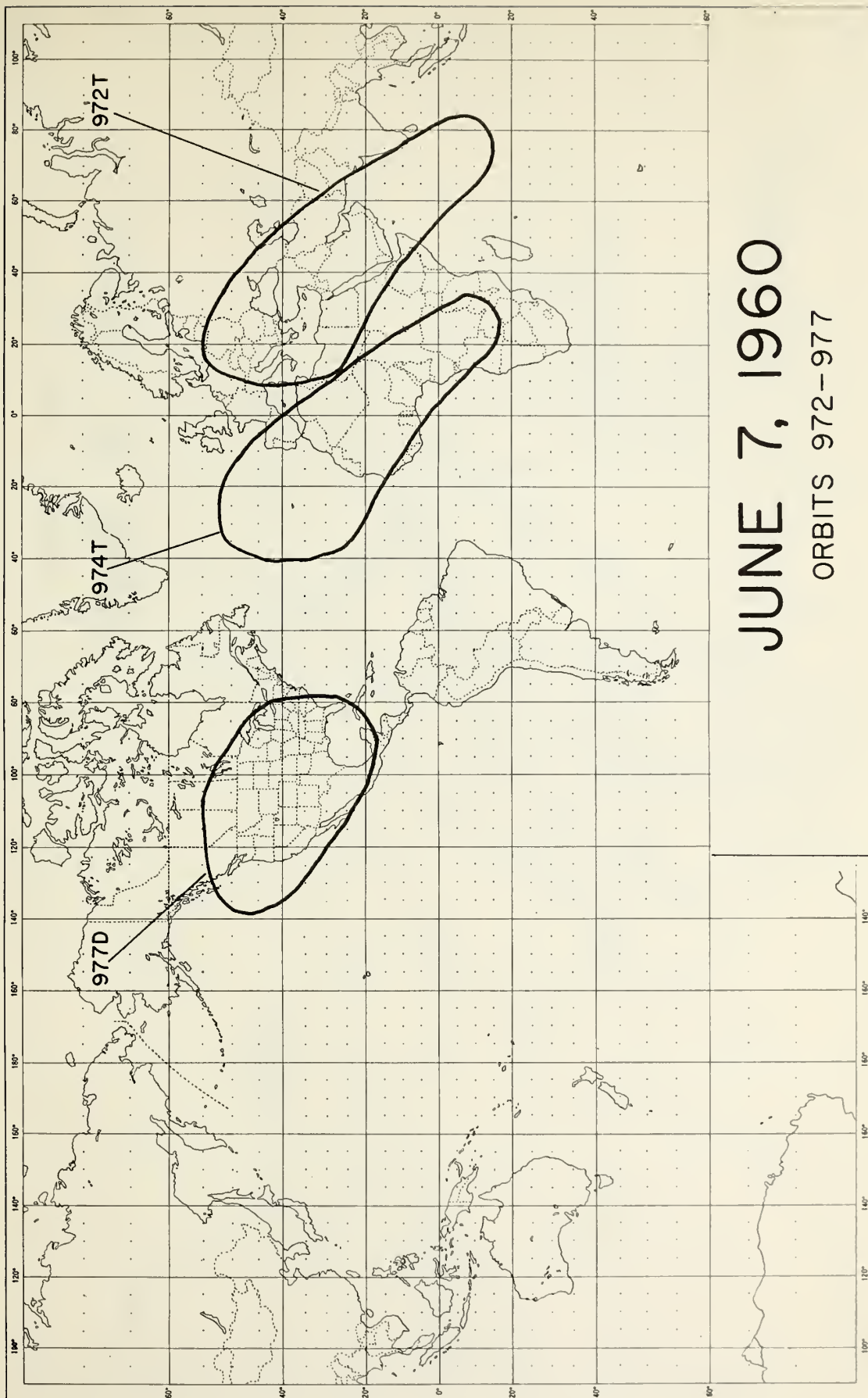


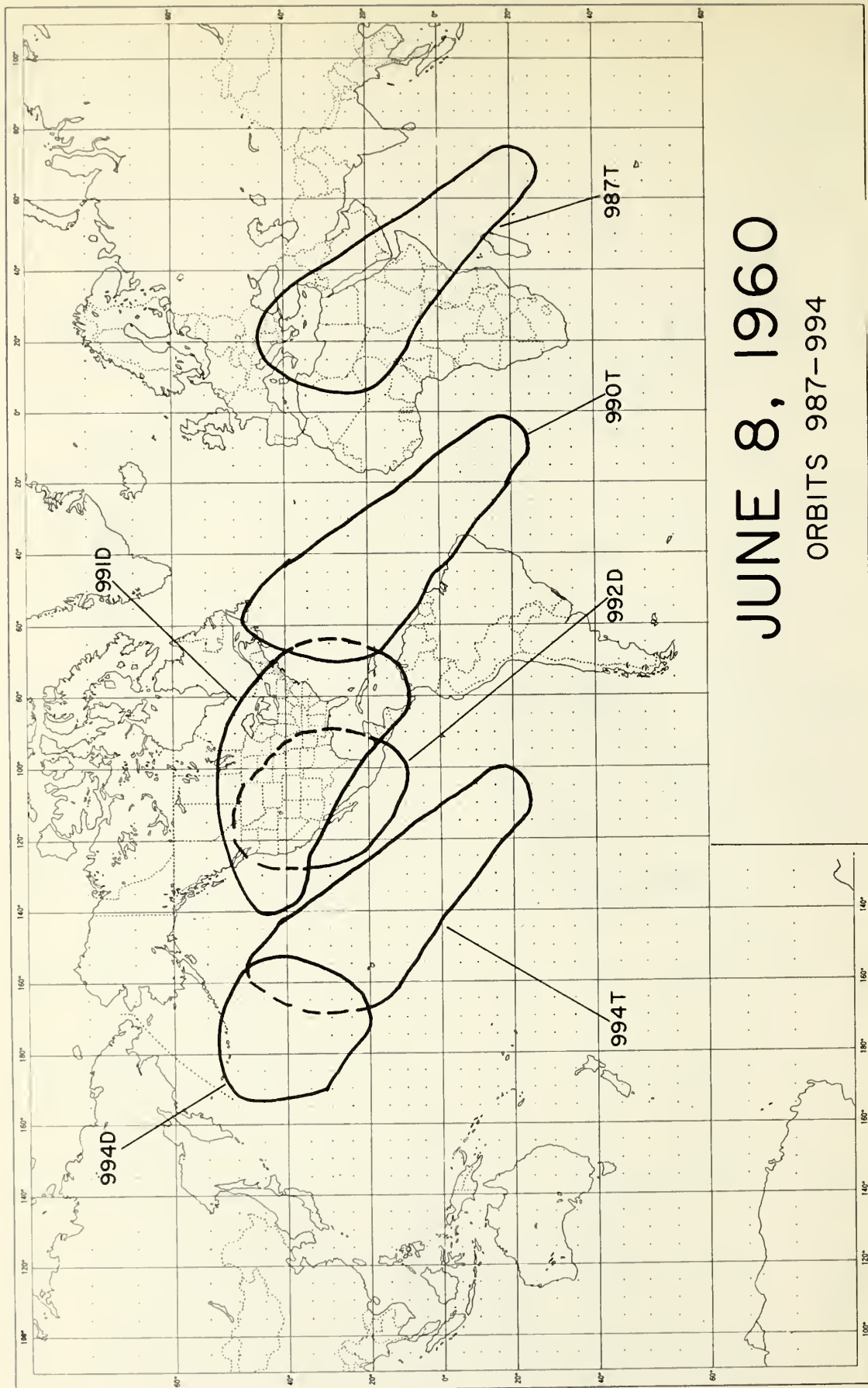
JUNE 4, 1960

ORBITS 931-934



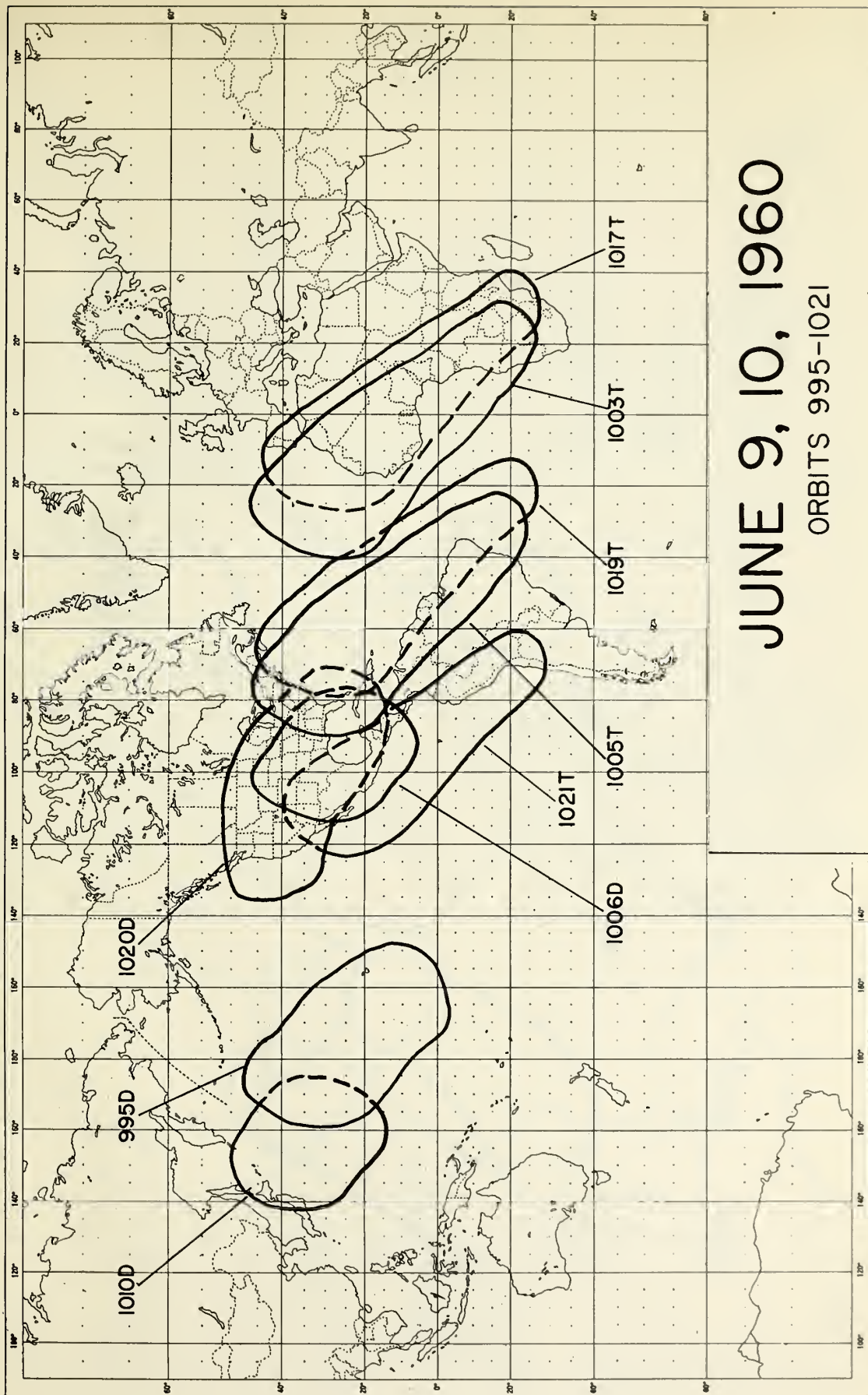


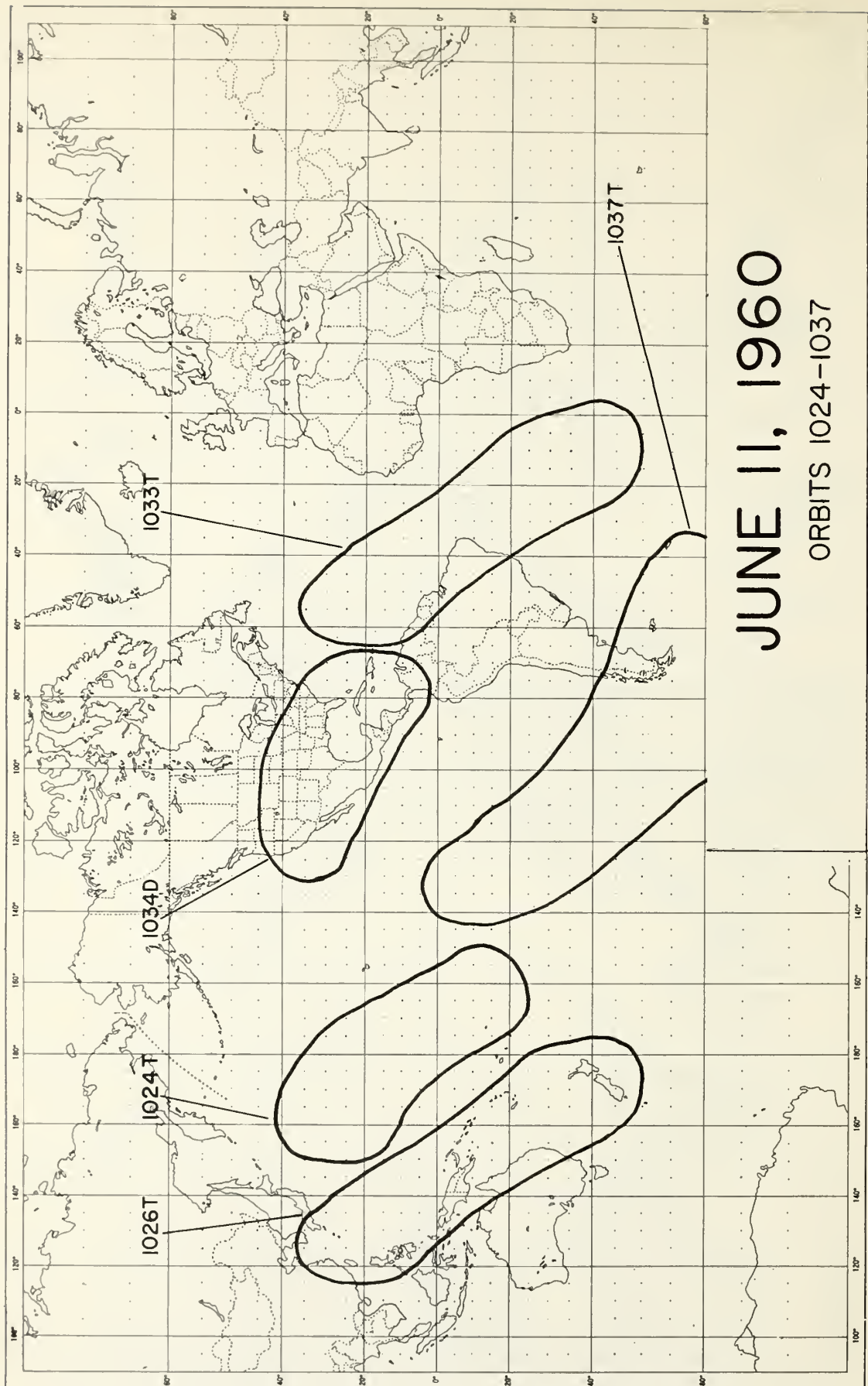


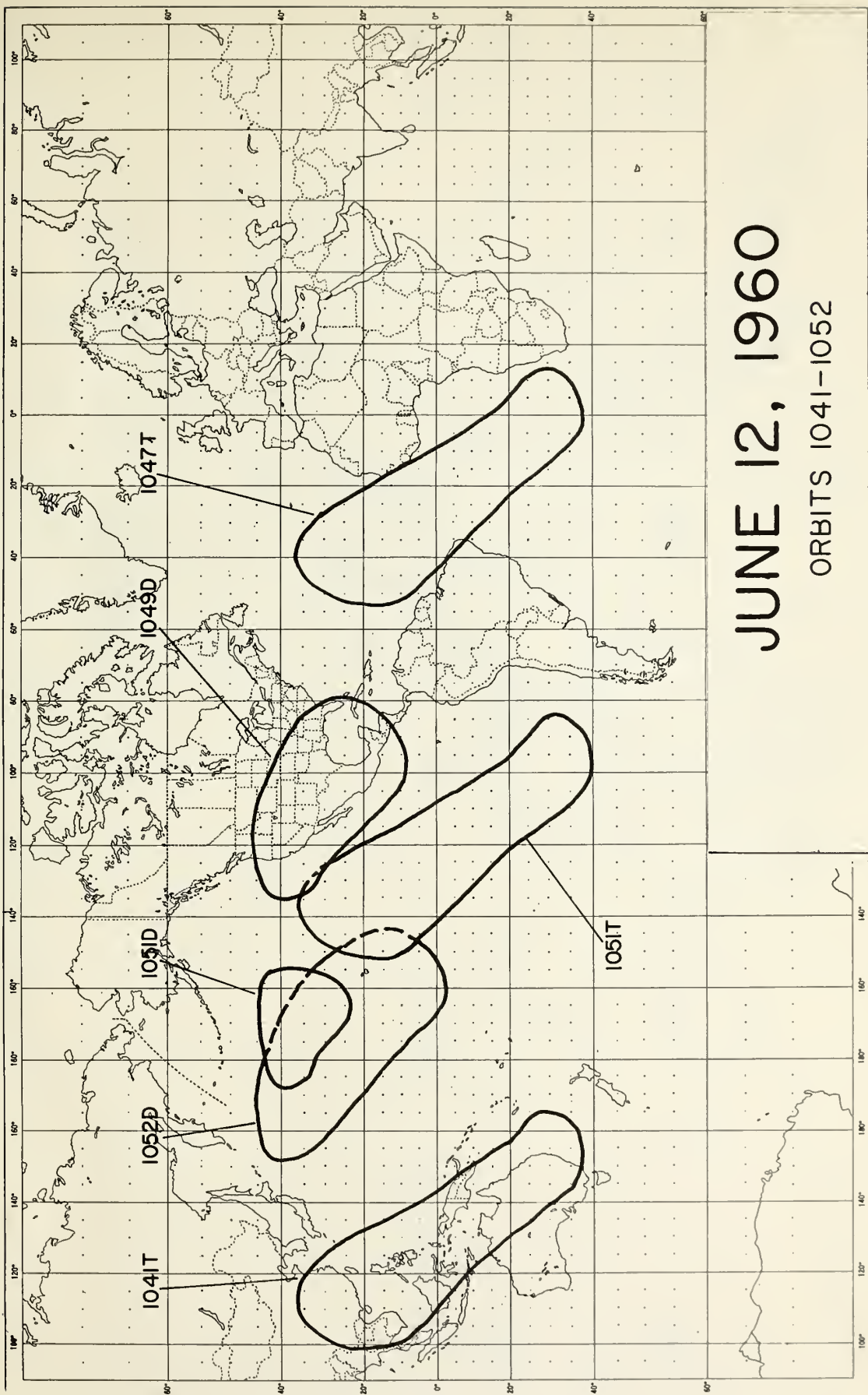


JUNE 8, 1960

ORBITS 987-994

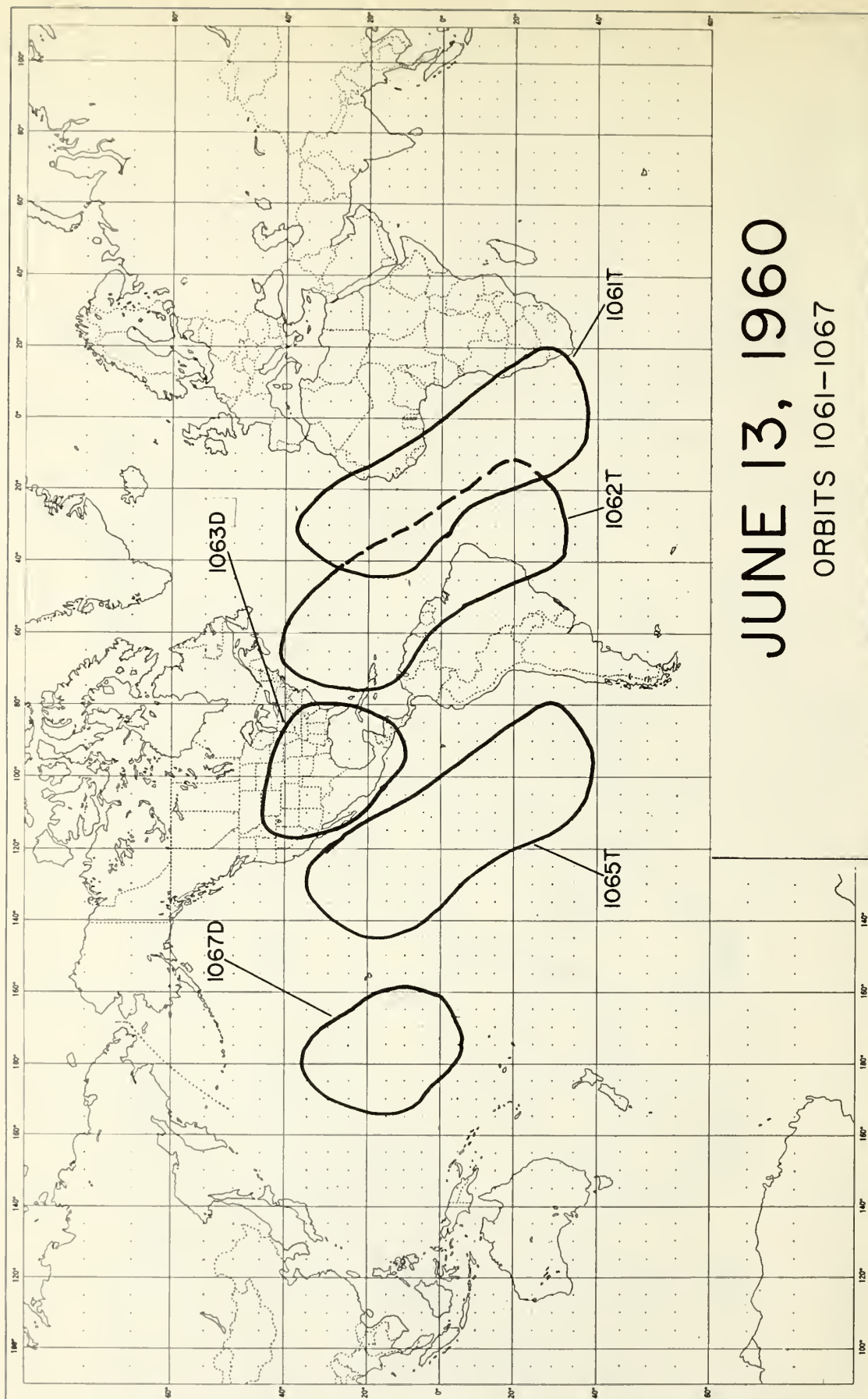






JUNE 12, 1960

ORBITS 1041-1052



JUNE 13, 1960

ORBITS 1061-1067

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